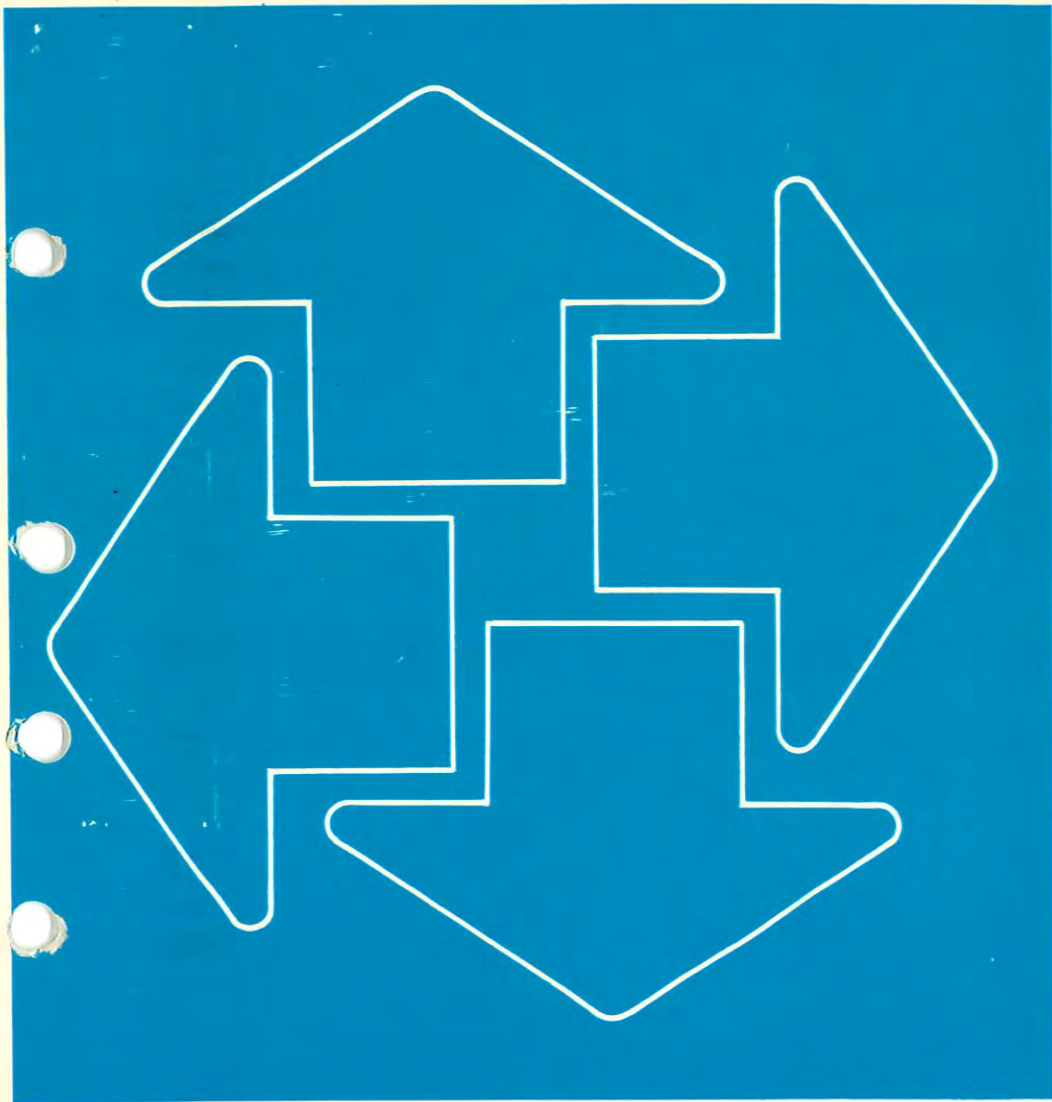


MANUAL
ON
**UNIFORM
TRAFFIC
CONTROL
DEVICES**

FOR STREETS AND HIGHWAYS



MANUAL ON **UNIFORM TRAFFIC CONTROL DEVICES**

FOR STREETS AND HIGHWAYS

DEVELOPED WITH THE COOPERATION OF
THE AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS
AND THE NATIONAL JOINT COMMITTEE
ON UNIFORM TRAFFIC CONTROL DEVICES

American Association of State Highway Officials
Institute of Traffic Engineers
National Committee on Uniform Traffic Laws and Ordinances
National Association of Counties
National League of Cities

Adopted by the
Federal Highway Administrator
as a National Standard for Application
on all Classes of Highways



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FEDERAL HIGHWAY ADMINISTRATION

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MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

INTRODUCTION

Traffic control devices are all signs, signals, markings, and devices placed on or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn, or guide traffic.

The need for high uniform standards was recognized long ago. The American Association of State Highway Officials (AASHO) published a manual for rural highways in 1927 and the National Conference on Street and Highway Safety published a manual for urban streets in 1929. But the necessity for unification of the standards applicable to different road and street systems was obvious. To meet this need, a joint committee of the American Association of State Highway Officials and the National Conference on Street and Highway Safety developed, and published in 1935, the original edition of this Manual on Uniform Traffic Control Devices. That committee, though changed from time to time in organization and personnel, has been in continuous existence and has been responsible for periodic revisions of the Manual, including this 1970 edition.

The current parent organizations of the National Joint Committee on Uniform Traffic Control Devices are: American Association of State Highway Officials, 341 National Press Building, Washington, D.C. 20004; Institute of Traffic Engineers, 2029 K Street, N.W., Washington, D.C. 20006; National Committee on Uniform Traffic Laws and Ordinances, 525 School Street, S.W., Washington, D.C. 20024; National Association of Counties, 1001 Connecticut Avenue, N.W., Washington, D.C. 20036; and the National League of Cities, 1612 K Street, N.W., Washington, D.C. 20006.

In the preparation of this Manual, the National Joint Committee on Uniform Traffic Control Devices has utilized its Executive Committee and the Technical Subcommittees for Research, Interpretations, Signs, Markings, Signals, Islands, Colors, Traffic Controls for School Areas, Traffic Controls for Street and Highway Construction and Maintenance Operations, and for Publications and Editing.

The National Joint Committee on Uniform Traffic Control Devices draws on the talents of persons in addition to its formal membership in the conduct of its work. All of the members on the National Joint Committee and members of its committees serve on a voluntary

basis, giving freely of their time in the Manual deliberations, both in technical committee work in their home areas and at the two meetings held each year.

Staff for the National Joint Committee on Uniform Traffic Control Devices, a Secretary and Staff Executive, is provided by the Federal Highway Administration, Department of Transportation. Correspondence should be addressed to the Secretary, National Joint Committee on Uniform Traffic Control Devices, Federal Highway Administration, Washington, D.C. 20591.

1970 REVISION

In recognition of the proven international value and need for symbols, and to present a uniform and better understood system of signing, this 1970 revision includes a wider use of symbols, both in the regulatory and warning series. Color coding is employed more extensively in signs, and to define direction of travel by pavement markings. This Manual also includes, for the first time, a complete and separate part covering traffic controls for school areas (Part VII). Standards for traffic signals (Part IV) also have been updated. Civil Defense Signing, Part VI, in the previous edition, is now included in Part II, Signs. Definitions applicable to this Manual are presented in Part VIII.

Highway authorities should provide a reasonable time period for changing existing installations to conform to this Manual. While installations should, for economy, be updated at the end of normal service life, public safety may sometimes dictate an earlier replacement. For example, the revised system of pavement markings should desirably be made during a relatively short period of time in each State and this coordinated on a regional basis. It is also recognized that motorists must be adequately informed about the new marking system before it is implemented.

It is expected that the implementation of this Manual on the Federal-aid highway systems, will be governed by federal directives. Because of the importance of uniform control device application on all roads and streets, local jurisdictions are encouraged to follow, as closely as possible, future implementation schedules issued for State or Federal highway systems.

Part I. GENERAL PROVISIONS

1A-1 Requirements of Traffic Control Devices

This Manual sets forth the basic principles that govern the design and usage of traffic control devices. These principles appear throughout the text in discussions of the devices to which they apply, and it is important that they be given primary consideration in the selection and application of each device.

The Manual presents traffic control device standards for all streets and highways regardless of type or class or the governmental agency having jurisdiction. Where a device is intended for limited application only, or for a specific system, the text specifies the restrictions on its use.

To be effective, a traffic control device should meet five basic requirements. They are:

1. Fulfill a need.
2. Command attention.
3. Convey a clear, simple meaning.
4. Command respect of road users.
5. Give adequate time for proper response.

In the case of regulatory devices, the actions required of motorists and pedestrians should be specified by State statute, or by local ordinance or resolution which are consistent with national standards. Uniformity of meaning is vital to effective traffic control devices. Meanings ascribed to devices in this Manual are in general accord with the Uniform Vehicle Code of the National Committee on Uniform Traffic Laws and Ordinances, which is the nationally recognized standard in this area.

Five basic considerations are employed to insure that these requirements are met. They are: design, placement, operation, maintenance, and uniformity.

Design of the device should assure that such features as size, contrast, colors, shape, composition, and lighting or reflectorization are combined to draw attention to the device; that shape, size, colors, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, reasonableness of the regulation, size and legibility combine to command respect. In the design of a

device, minor modifications of the specified design elements may be necessary under certain conditions, provided that the essential appearance characteristics are met.

Placement of the device should assure that it is within the cone of vision of the user so that it will command attention; that it is positioned with respect to the point, object, or situation to which it applies to aid in conveying the proper meaning; and that its location, combined with suitable legibility, is such that a driver traveling at normal speed has adequate time to make the proper response.

Operation or application should assure that appropriate devices and related equipment be installed to meet the traffic requirements at a given location. Furthermore, the device must be operated and placed in a uniform and consistent manner to assure, to the extent possible, that the motorist can be expected to properly respond to the device, based on his previous exposure to similar traffic control situations.

Maintenance of devices should be to high standards to assure that legibility is retained, that the device is visible, and that it is removed if no longer needed. Clean, legible, properly mounted devices in good working condition command the respect of motorists and pedestrians. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove unnecessary traffic control devices. The fact that a device is in good physical condition should not be a basis for deferring needed replacement or change. Furthermore, carelessly executed maintenance can destroy the value of a group of devices by throwing them out of balance. For example, replacement of a sign in a group or series by one that is disproportionately large may tend to deprecate others in the vicinity.

Uniformity of traffic control devices simplifies the task of the road user because it aids in recognition and understanding. It aids road users, police officers, and traffic courts by giving everyone the same interpretation. It aids public highway and traffic officials through economy in manufacture, installation, maintenance and administration.

Simply stated, uniformity means treating similar situations in the same way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this may be worse, in that such misuse may result in disrespect at those locations where the device is needed.

1A-2 Responsibility for Traffic Control Devices

The responsibility for traffic control devices rests with a multitude of governmental jurisdictions. In virtually all States, traffic control

devices placed and maintained by State and local officials are required by statute to conform to a State Manual which must be in substantial conformance with this Manual. Many Federal agencies have regulations requiring standards in conformance with this Manual for their control device applications.

The Uniform Vehicle Code has the following provision in Section 15-104 for the adoption of a uniform manual:

"The (State Highway Commission) shall adopt a manual and specifications for a uniform system of traffic-control devices consistent with the provisions of this chapter for use upon highways within this State. Such uniform system shall correlate with and so far as possible conform to the system set forth in the most recent edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, and other standards issued or endorsed by the Federal Highway Administrator."

Under authority granted by Congress in 1966, the Secretary of Transportation has indicated that traffic control devices on all streets and highways in each State should conform with standards issued or endorsed by the Federal Highway Administrator. In addition, since 1944, Congress has provided that signs, signals and markings installed on highways constructed with Federal-aid funds shall be subject to approval of the State highway department with the concurrence of the Secretary of Transportation who is directed by law to concur only in installations that promote safe, efficient highway use.

1A-3 Engineering Study Required

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not a substitute for engineering judgment. It is the intent that the provisions of this Manual be standards for traffic control devices installation, but not a legal requirement for installation.

Qualified engineers are needed to exercise the engineering judgment inherent in the selection of traffic control devices, just as they are needed to locate and design the roads and streets which the devices complement. Jurisdictions with responsibility for traffic control, that do not have qualified engineers on their staffs, should seek assistance from the State highway department, their county, a nearby large city, or a traffic consultant.

1A-4 Meanings of "Shall," "Should" and "May"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall," "should" and "may" are

used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual by the use of these words, the following definitions apply:

1. **SHALL**—A *mandatory* condition. Where certain requirements in the design or application of the device are described with the “shall” stipulation, it is mandatory when an installation is made that these requirements be met.

2. **SHOULD**—An *advisory* condition. Where the word “should” is used, it is considered to be advisable usage, recommended but not mandatory.

3. **MAY**—A *permissive* condition. No requirement for design or application is intended.

1A-5 Developing New Standards and Interpretation and Revision of Existing Standards

Advances in technology will produce changes in the highway, the motor vehicle, and in driver proficiency and portions of the system of control devices in this Manual will gradually become obsolete. In addition, unique situations often arise for device applications which may require interpretation or clarification of this Manual. It is important to have a procedure for recognizing these developments and for introducing new ideas and modifications into the system.

The following procedures will generally apply to the handling of interpretations, experimentation and changes to the MUTCD:

1. The request for any clarification, permission to experiment or change in the Manual should be addressed to one of the appropriate organizations of the National Joint Committee who will review the request and advise the Federal Highway Administration in accordance with the procedures and policies of the respective organizations. These organizations include the American Association of State Highway Officials (AASHO), the Institute of Traffic Engineers (ITE), the National Association of Counties, (NAC), the National Committee on Uniform Traffic Laws and Ordinances (NCUTLO), and the National League of Cities (NLC). The action on the request for interpretation, on the approval of an alternate or for experimentation will be by the Federal Highway Administrator. In the event that a review in one of these organizations is not feasible, the request may be addressed directly to the Federal Highway Administrator, and marked for the attention of the Director, Office of Traffic Operations, who will request a recommendation from the appropriate organization of the Joint Committee before final action is taken.

2. Requests for the use of new devices or methods should contain information on why a device or procedure recommended in the MUTCD could not be used; advantages of using the proposed procedure or device; any factual supporting data showing why the proposed device is considered to be the solution and/or study procedures to be used for field tests of the proposed device.

3. The organizations of the National Joint Committee will be responsible for dissemination of official rulings to their respective members.

4. Rulings on requests will be given as:

(a) *Interpretations*—this would generally be a clarification of intended applications of Manual requirements or determinations of applications of Manual requirements for specific situations.

(b) *Approval as an alternate*—this would be permission to use a new device or modification, even though the Manual prescribes a device for the same purpose. Generally, it would be expected that the proposed alternate would offer advantages over the device prescribed in the Manual.

(c) *Approval for experimentation*—this would be permission to use, for test and evaluation, an unproven device or modification which appeared to be a sound idea. The type of information to be gathered during the test and evaluation of the device would be stated as part of the request and the gathering of these data would be a conditional part of the approval.

5. The Federal Highway Administration will maintain official files of interpretations and other actions taken on the development of improved standards.

1A-6 Relation to Other Documents

Two publications by the National Committee on Uniform Traffic Laws and Ordinances are specifically designed to provide the content and language of legislation needed to give regulatory devices the same meaning in all jurisdictions. These are the Uniform Vehicle Code (chapter 11, Rules of the Road) for States, and the Model Traffic Ordinance for municipalities. Both the Code and the Ordinance require the placing of signs or other traffic control devices to make some of their provisions effective, and both define the legal meaning of certain devices. The Code directs the State authorities to adopt a manual for a uniform system of traffic control devices, and the Ordinance requires devices under municipal jurisdiction to

conform thereto. The adoption of appropriate legislation is an essential step toward uniformity.

The standards in the *Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways*, published by the American Association of State Highway Officials, have been incorporated herein for freeway application, providing one document for all streets and highways.

Other documents, to the extent they are incorporated by specific reference, are made part of this Manual:

- Standard Alphabets—Federal Highway Administration, 1966
- Standard Color Charts—Federal Highway Administration, 1970
- Standard Highway Signs—Federal Highway Administration, 1970
- Institute of Traffic Engineers, Adjustable Face Vehicle Traffic Control Signal Head Standards, 1970
- Association of American Railroads, Bulletin 6, Railroad Highway Grade Crossing Protection, 1966
- Institute of Traffic Engineers, Adjustable Face Pedestrian Signal Head Standard, 1963

Other documents that are useful sources of information with respect to utilization of these standards include:

- Traffic Engineering Handbook—Institute of Traffic Engineers
- Highway Capacity Manual—Highway Research Board
- A Policy on Geometric Design of Rural Highways—American Association of State Highway Officials
- A Policy on Arterial Highways in Urban Areas—American Association of State Highway Officials
- Manual of Traffic Engineering Studies—Institute of Traffic Engineers
- Volume 12, Highway Safety Program Manual, Highway Design Construction and Maintenance, Federal Highway Administration
- Volume 13, Highway Safety Program Manual, Traffic Control Devices, Federal Highway Administration

1A-7 Color Code

The following color code establishes general meanings for eight colors in a total of twelve colors that have been identified as being appropriate for use in conveying traffic control information. Central values and tolerance limits for each color are available.¹

The four colors for which no meaning has been assigned are being reserved for future applications. The meanings described in this

¹ Available from the Federal Highway Administration, Washington, D.C. 20591.

Section are of a general nature. More specific assignments of colors are given in the individual Parts of this Manual relating to each class of devices.

Color Code:

RED—Stop or prohibition.

GREEN—Indicated movements permitted, direction guidance.

BLUE—Motorist services guidance.

YELLOW—General warning.

BLACK—Regulation.

WHITE—Regulation.

ORANGE—Construction and maintenance warning.

PURPLE—Unassigned.

BROWN—Public recreation and scenic guidance.

STRONG YELLOW-GREEN—Unassigned.

LIGHT BLUE—Unassigned.

CORAL—Unassigned.

Part II. SIGNS

A. INTRODUCTION AND GENERAL SPECIFICATIONS

2A-1 Function of Signs

Signs should be used only where warranted by facts and field studies. Signs are essential where special regulations apply at specific places or at specific times only, or where hazards are not self-evident. They also give information as to highway routes, directions, destinations and points of interest. Signs ordinarily are not needed to confirm rules of the road.

2A-2 Scope of Sign Standards

This Manual prescribes standards for the signing within the right-of-way of all classes of public highways. Detailed standards for Regulatory signs are given in Part II-B and for Warning signs in Part II-C.

The requirements and standards for Guide signs will depend on the particular highway class on which they are to be used. For this purpose the following meanings apply:

1. Conventional Road—A road or street other than a freeway or expressway.
2. Expressway—A divided highway with partial control of access.
3. Freeway—An expressway with full control of access.

Guide sign requirements for conventional roads are given in Part II-D, for expressways in Part II-E and for freeways in Part II-F. Expressways are characterized by three distinctive features—divided roadways, controlled access, and some grade separated intersections. Where any of these features are lacking, prescribed expressway signs may not be fully applicable and standard signs for conventional roads should be used, with such enlargement or other modification as is required to adapt them to existing conditions.

Standard guide signing for the National System of Interstate and Defense Highways shall be in accordance with Part II-F, Freeways. These standards were developed and approved by the American Association of State Highway Officials and incorporated herein to be applicable to all freeways of comparable design.¹ As many pro-

¹ Formerly available as *Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways*.

visions for expressway signing have application on freeways, references are made to Part II-E to minimize duplication.

Signing for Civil Defense emergencies is contained in Part II-G.

Roadway geometric design and signing should be coordinated so that signing can be effectively placed to give the motorist necessary directional and warning information.

This Manual also includes two special parts dealing separately with construction and maintenance signing (Part VI), and signing for school areas (Part VII). Signing for the protection of the public and the workmen at highway construction and maintenance sites is a specialized operation which, though it uses standard signs, calls for numerous special designs and applications. It is separately treated primarily so that its specifications will be conveniently available to contractors and highway employees who are not concerned with other parts of this Manual.

Signs for school area traffic control are specified in Part VII. This special section of this Manual was developed to achieve uniformity of traffic control in school areas. Each traffic control sign and control method described in this part fulfills a specific function related to a specific traffic condition.

2A-3 Legal Authority

Traffic signs shall be placed only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic sign or its support shall bear any message that is not essential to traffic control. Specific reference is made to Section 11-205 of the Uniform Vehicle Code, Revised 1968.

Any unauthorized sign placed on the highway right-of-way without authority by a private organization or individual constitutes a public nuisance. All unofficial and nonessential signs should be removed.

With proper authority being given, construction contractors and public utility companies are permitted to erect temporary construction and maintenance signs at work sites to protect the public, equipment, and workmen, provided that such signs conform to the standards of this Manual.

Effective traffic control depends not only on appropriate application of devices, but on reasonable enforcement of regulations as well. Standards in this Manual are based on that concept.

2A-4 Standardization of Application

Each standard sign shall be displayed only for the specific purpose prescribed for it in this Manual. Before any new highway or any

detour or temporary route is opened to traffic all necessary signs shall be in place.

Signs required by road conditions or restrictions shall be removed immediately when those conditions cease to exist or the restrictions are withdrawn.

Uniformity of application is as important as standardization with respect to design and placement. Identical conditions should always be marked with the same type of sign, irrespective of where those particular conditions occur.

Determination of the particular sign or signs to be applied to a specific condition shall ordinarily be made in accordance with the criteria set forth in the following pages. However, engineering judgment is essential to the proper use of signs, the same as with other traffic control devices. Traffic engineering studies may indicate that signs would be unnecessary at certain locations. The judgment resulting from traffic engineering studies of physical and traffic factors should be depended upon to determine locations where signs are deemed necessary.

It is recognized that urban traffic conditions differ from rural, and in many instances signs must be applied and located differently. Where pertinent and practical, therefore, this Manual sets forth separate recommendations for rural and urban conditions.

2A-5 Variable Message Signs

Variable message signs are designed to have one or more messages that may be displayed or deleted as required. Such a sign may be changed manually, by remote control, or by automatic controls that can "sense" the conditions that require special sign messages.

Variable signs should conform with the same shapes and colors and be of the same dimensions as standard signs provided in this Manual.

2A-6 Excessive Use of Signs

Care should be taken not to install too many signs. A conservative use of regulatory and warning signs is recommended as these signs, if used to excess, tend to lose their effectiveness. On the other hand, a frequent display of route markers and directional signs to keep the driver informed of his location and his course will not lessen their value.

2A-7 Classification of Signs

Functionally, signs are classified as follows:

Regulatory signs give notice of traffic laws or regulations.

Warning signs call attention to conditions on, or adjacent to, a highway or street that are potentially hazardous to traffic operations.

Guide signs show route designations, destinations, directions, distances, services, points of interest, and other geographical or cultural information.

2A-8 Standardization of Signs

In situations where messages are required other than those herein provided for, the signs shall be of the same shape and color as standard signs of the same functional type.

The term "legend" as used in this Manual includes all word messages and symbol designs that are intended to convey specific meanings.

The basic requirements of a highway sign are that it be legible to those using it and that it be understood in time to permit a proper response. This means high visibility, lettering or symbols of adequate size, and a short legend for quick comprehension by a driver approaching a sign at high speed. Standardized colors and shapes are specified so that the several classes of traffic signs can be promptly recognized. Simplicity and uniformity in design, position, and application are important.

2A-9 Design

Uniformity in design includes shape, color, dimensions, legends, and illumination or reflectorization. Detailed drawings of the standard signs illustrated in this Manual are available to State and local highway and traffic authorities, sign manufacturers, and similarly interested agencies.² All symbols shall be unmistakably similar to those shown, and where a word message is applicable, the wording shall be as herein provided. Standardization of these designs does not preclude further improvement by minor changes in the proportion of symbols, stroke-width, height of letters, width of borders, or layout of word messages, but all shapes and colors shall be as indicated.

In the specifications for individual signs, the legend, color, and size are shown in the accompanying illustrations, and are not always detailed in the text.

2A-10 Shapes

Standard sign shapes are:

The octagon shall be reserved exclusively for the STOP sign.

² Available from the Federal Highway Administration, Washington, D.C. 20591.

The equilateral triangle, with one point downward, shall be reserved exclusively for the YIELD sign.

The round shape shall be used for the advance warning of a railroad crossing and for the civil defense evacuation route marker.

The pennant shape, an isosceles triangle, with its longest axis horizontal, shall be used to warn of no passing zones.

The diamond shape shall be used only to warn of existing or possible hazards either on the roadway or adjacent thereto.

The rectangle, ordinarily with the longer dimension vertical, shall be used for regulatory signs, with the exception of STOP signs and YIELD signs.

The rectangle, ordinarily with the longer dimension horizontal, shall be used for guide signs, with the exception of certain route markers and recreational area guide signs.

The trapezoid shape, as shown in section 2D-44, may be used for recreational area guide signs.

The pentagon, point up, shall be used for School Advance and School Crossing signs (Part VII).

Other shapes are reserved for special purposes; for example, the shield or other characteristic design for route markers and crossbuck for railroad crossings.

2A-11 Sign Colors

The colors to be used on standard signs shall be as follows:

Red is used only as a background color for STOP signs, multi-way supplemental plates, DO-NOT-ENTER messages, WRONG WAY signs and on Interstate route markers; as a legend color for YIELD signs, parking prohibition signs, the circular outline and diagonal bar prohibitory symbol.

Black is used as a background on ONE WAY signs, certain weigh station signs and night speed limit signs as specified herein. Black is used as a message on white, yellow and orange signs.

White is used as the background for route markers, guide signs, the Fallout Shelter Directional sign, and regulatory signs, except STOP signs, and for the legend on brown, green, blue, black and red signs.

Orange is used as a background color for construction and maintenance signs and shall not be used for any other purpose.

Yellow is used as a background color for warning signs, except where orange is specified herein, and for school signs (Part VII).

Brown is used as a background color for guide and information signs related to points of recreational or cultural interest.

Green is used as a background color for guide signs (other than those using brown or white), mileposts, and as a legend color with a white background for permissive parking regulations.

Blue is used as a background color for information signs related to motorist services (including police services and rest areas) and the Evacuation Route Marker.

Four other colors—purple, light blue, coral, and strong yellow-green—have been identified as suitable for highway use and are being reserved for future needs.

Wherever white is specified herein as a sign color, it is understood to include silver-colored reflecting coatings or elements that reflect white light.

2A-12 Dimensions

The sign dimensions prescribed in this Manual shall be standard for application on public highways. Increases above these standard sizes are desirable where greater legibility or emphasis is needed. For expressways, special designs or large signs are prescribed. In the enlargement of signs, standard shapes and colors shall be used and standard proportions shall be retained insofar as practicable. Wherever practical the overall dimensions of the sign plates should be increased in 6-inch increments. The use of smaller than “standard” size signs may sometimes be justified.

2A-13 Symbols

Symbol designs shall in all cases be essentially like those shown in this Manual.

A wider adoption of symbols in preference to word message is a desirable and important step toward the greater safety and facilitation of traffic.

A change from word messages to symbols, particularly in the regulatory series, will require significant time for public education and transition. Consequently, this Manual includes educational plaques to accompany new symbol signs and continues, as an alternate, the previous standard word message signs in many cases. This inclusion is a recognition of the practicalities of a change of this magnitude and does not diminish the intent that an orderly transition to a consistent symbol system is desirable and should proceed as rapidly as public acceptance and other considerations permit.

2A-14 Word Messages

Where applicable, standard wordings as shown in this Manual shall be used for sign legends. Word messages should be as brief as possible and the lettering should be large enough to provide the necessary legibility distance.

Abbreviations should be kept to a minimum, and should include only those that are commonly recognized and understood, such as

Ave., Blvd., N. (for north), R. R., or Jct. Since long names can often be partially recognized by their length, it is sometimes permissible to put them in slightly smaller lettering than would otherwise be required.

2A-15 Lettering

Sign lettering shall be in upper-case letters of the type approved by the National Joint Committee on Uniform Traffic Control Devices, except that destination names may be in lower-case lettering, with initial upper-case. Standard upper-case and lower-case alphabets have been prepared.³

Use of the Series A and B alphabets is restricted to street-name and parking signs because of the limited breadth and stroke width.

As a guide to choice of alphabets, tests have shown that, for any given legend, better legibility can be obtained by using a relatively wide spacing between letters than by using wider and taller letters with a cramped space.

2A-16 Illumination and Reflectorization

Regulatory and warning signs, unless excepted in the standards covering a particular sign or group of signs, shall be reflectorized or illuminated to show the same shape and color both by day and night. All overhead sign installations should be illuminated where an engineering study shows that reflectorization will not perform effectively. Reflectorization, non-reflectorization, or illumination of guide signs shall be as provided in subsequent sections.

2A-17 Means of Illumination

Illumination may be by means of :

1. A light behind the sign face, illuminating the main message or symbol, or the sign background, or both, through a translucent material; or
2. An attached or independently mounted light source designed to direct essential uniform illumination over the entire face of the sign; or
3. Some other effective device, such as luminous tubing shaped to the lettering or symbol, patterns of incandescent light bulbs, or luminescent panels that will make the sign clearly visible at night.

Street or highway lighting is not regarded as meeting the requirements for sign illumination.

³ Available from the Federal Highway Administration, Washington, D.C. 20591.

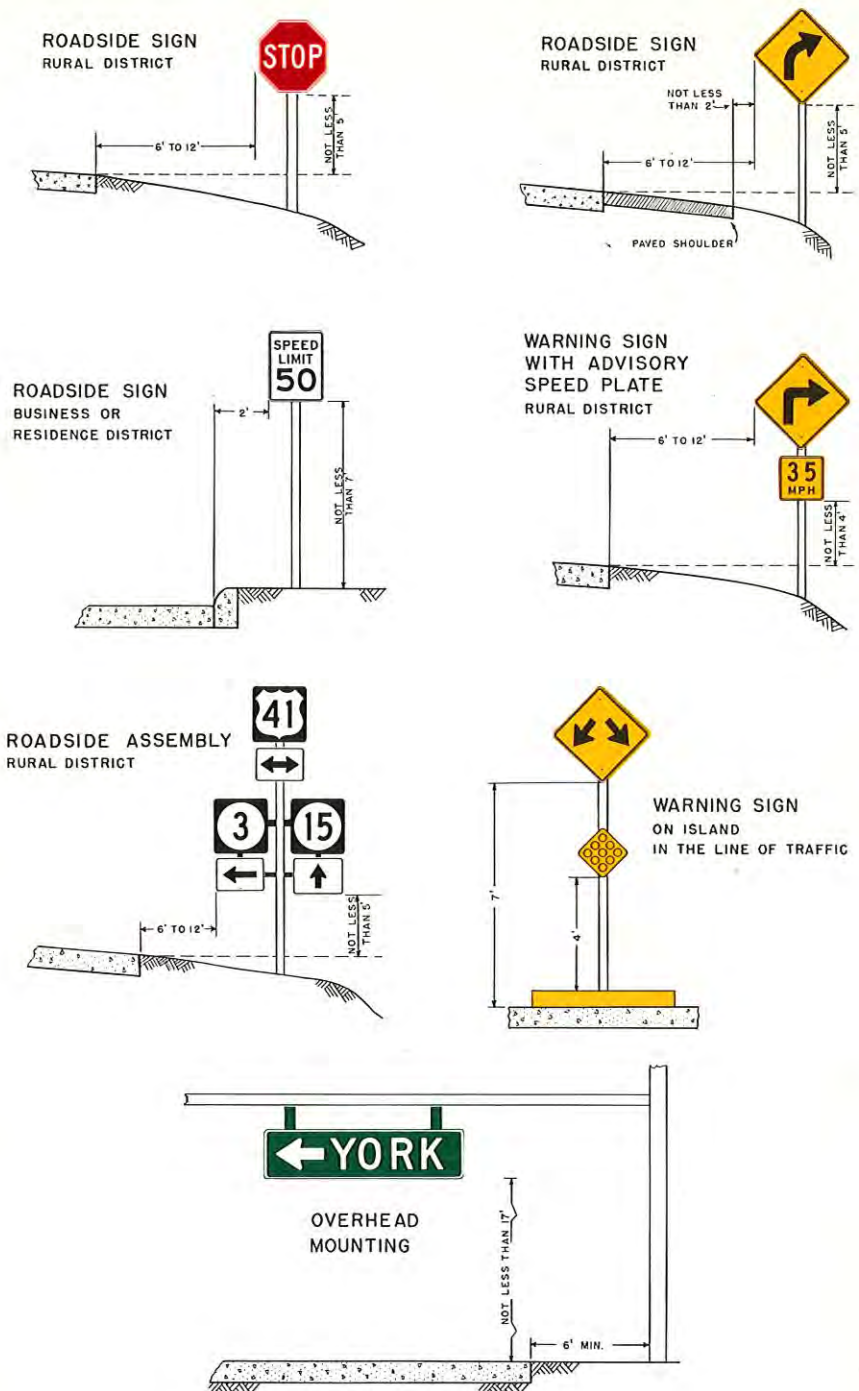


Figure 2-1. Height and lateral location of signs—typical installations.

2A-18 Means of Reflectorization

Reflectorization may be by means of:

1. Reflector "buttons" or similar units set into the symbol or message; or
2. Reflecting coatings, either on the sign background or where a white legend is used on a black or colored background in the symbol or message and border.

2A-19 Sign Borders

With few exceptions, all signs illustrated herein shall have a border of the same color as the legend, at or just inside the edge. A dark border should be set in from the edge, while a white border should extend to the edge of the panel. A suitable border for 30-inch signs with a light background is from one-half to three-quarters of an inch in width, one-half inch from the edge. For similar signs with a white border, a width of an inch is appropriate. For other sizes the border widths should be of similar proportions, but not to exceed the stroke-width of the major lettering of the sign. On signs exceeding 6 feet by 10 feet in size, the border should be approximately 2 inches wide, or on unusually large signs, 3 inches.

The corners of the sign border shall be rounded. Where practicable, the corners of the sign panels should also be rounded to fit the border.

2A-20 Supplemental Beacons

A hazard identification beacon (sec. 4E-1) may be used only to supplement an appropriate warning or regulatory sign. The beacon shall not be used within the border of the sign.

2A-21 Standardization of Location

Standardization of position cannot always be attained in practice; however, the general rule is to locate signs on the right-hand side of the roadway, where the driver is looking for them. On wide expressways, or where some degree of lane-use control is desirable, or where space is not available at the roadside, overhead signs are often necessary. Signs in any other locations ordinarily should be considered only as supplementary to signs in the normal locations. Under some circumstances signs may be placed on channelizing islands or (as on sharp curves to the right) on the left-hand shoulder of the road, directly in front of approaching vehicles. A supplementary sign located on the left of the roadway is often helpful on a multi-lane road where traffic in the right-hand lane may obstruct the view to the right.

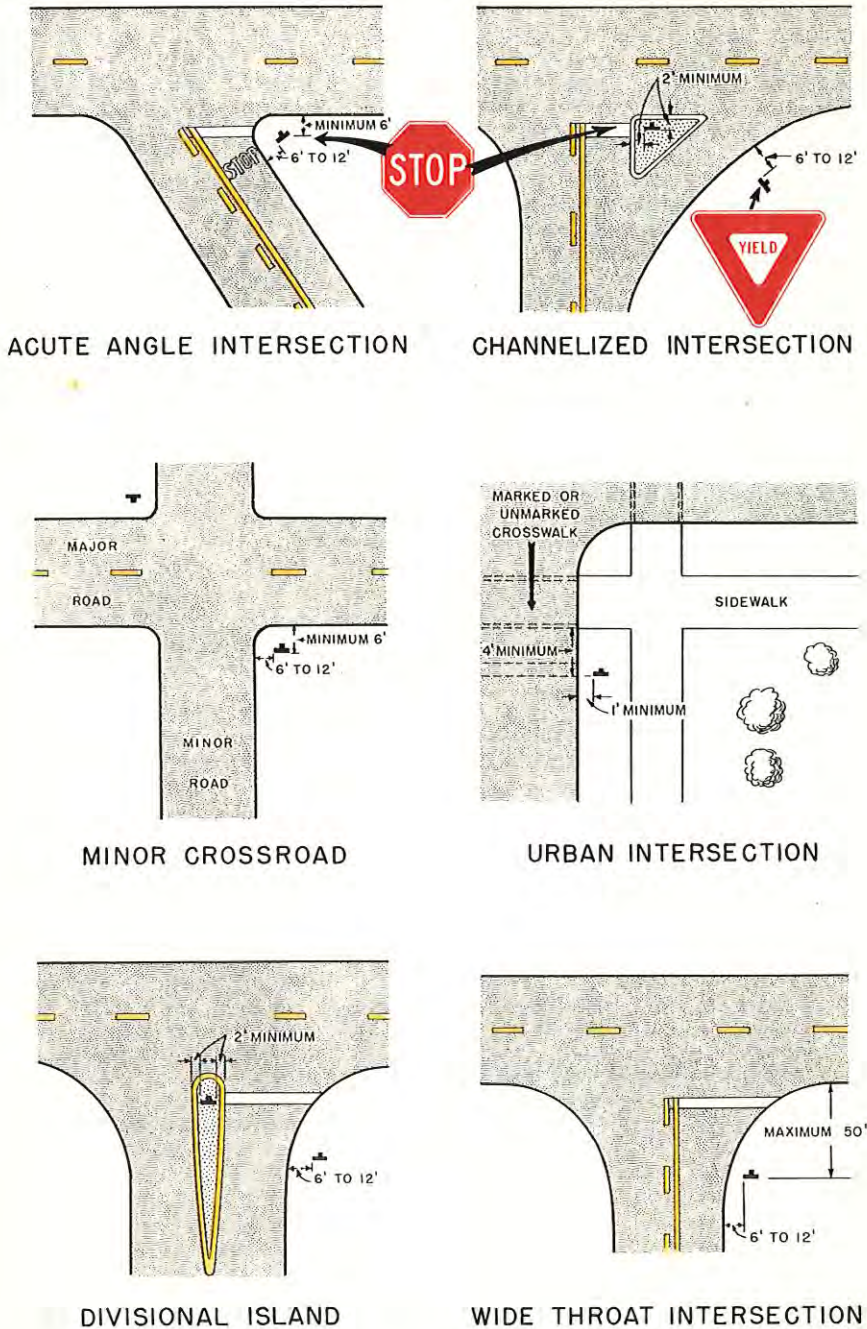


Figure 2-2. Typical locations for stop signs and yield signs.

Normally, signs should be individually erected on separate posts or mountings except where one sign supplements another or where route or directional signs must be grouped. In general, signs should be located to optimize nighttime visibility and minimize the effects of mud spatter and in conformance with safety factors related to fixed obstacles near the roadway. Signs should be located so that they do not obscure each other or are hidden from view by other roadside objects. Signs requiring different decisions by the motorist must be spaced sufficiently far apart for him to make the required decisions. The spacing shall be determined in units of time as determined by the expected vehicle approach speed.

Standard positions for a number of typical signs are illustrated in figures 2-1 to 2-4.

2A-22 Overhead Sign Installations

The operational requirements of our present highway system are such that overhead signs will have value at many locations. The factors justifying the erection of overhead sign displays are not definable in specific numerical terms, but the following conditions deserve consideration :

1. Traffic volume at or near capacity
2. Complex interchange design
3. Three or more lanes in each direction
4. Restricted sight distance
5. Closely spaced interchanges
6. Multi-lane exits
7. Large percentage of trucks
8. Background of street lighting
9. High speed of traffic
10. Consistency of sign message location through a series of interchanges
11. Insufficient space for ground signs
12. Junction of an Interstate route with another freeway

The existence of any one or more of the conditions listed does not automatically justify the use of signs overhead. Rather, overhead signs have application in lieu of or as an adjunct to ground signs when engineering study indicates that they are needed. Some of the elements listed above can be made less critical by close coordination between design and operation.

2A-23 Height

Signs erected at the side of the road in rural districts shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the near edge of the pavement. In business, commer-

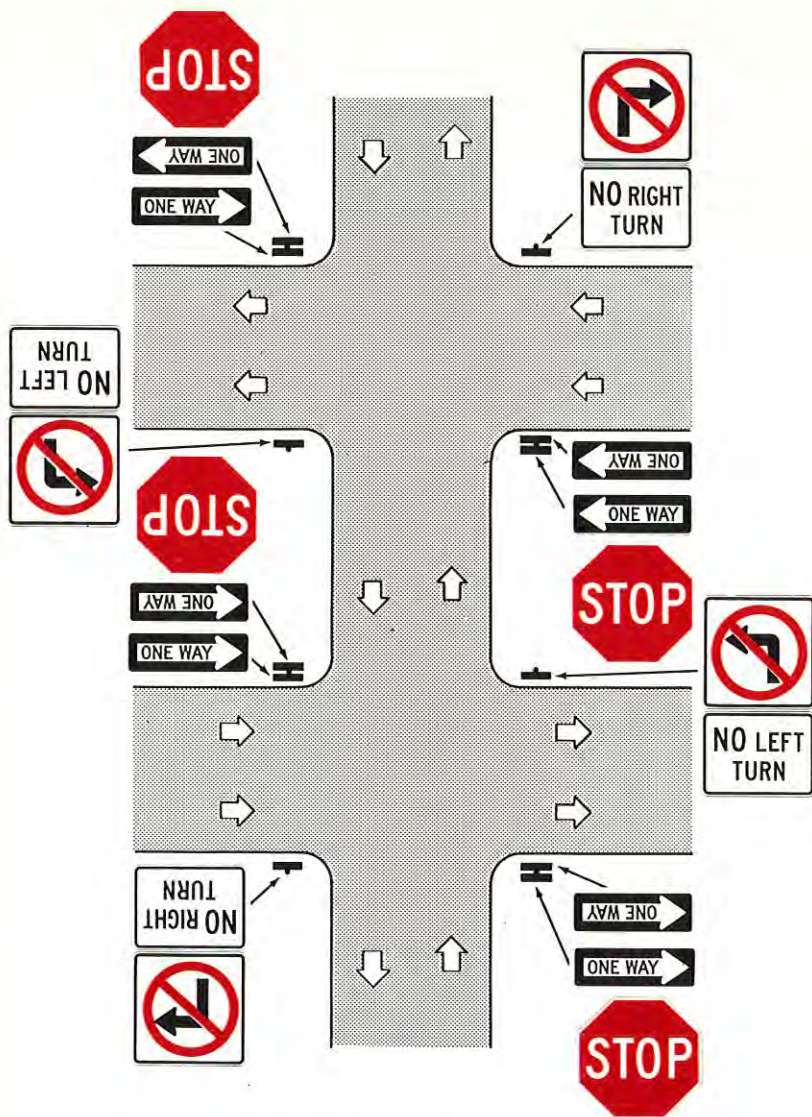


Figure 2-3. Location of one-way and turn prohibition signs.

cial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet. The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the appropriate height specified above.

The height requirements for ground installations on expressways vary somewhat from those on conventional streets and highways. Directional signs on expressways shall be erected with a minimum height of 7 feet (from the level of the near edge of the pavement to

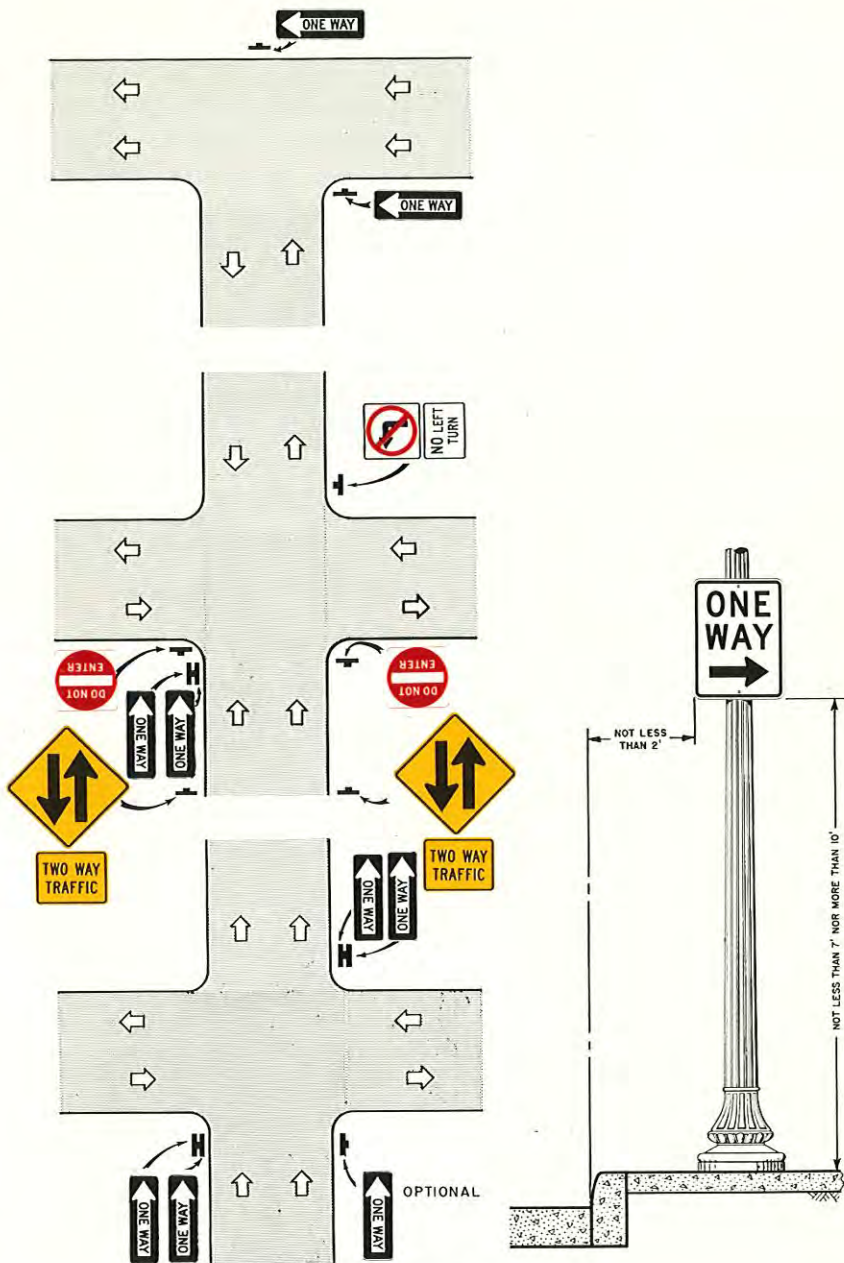


Figure 2-4. Location of one-way signs.

the bottom of the sign). If, however, a secondary sign is mounted below another sign, the major sign shall be at least 8 feet and the secondary sign at least 5 feet above the level of the pavement edge.

All route markers and warning and regulatory signs on expressways shall be at least 6 feet above the level of the pavement edge. However, where signs are placed 30 feet or more from the edge of the nearest traffic lane for increased roadside safety, the height to the bottom of such signs may be 5 feet above the level of the pavement edge.

A route marking assembly consisting of a route marker with an auxiliary plate (sec. 2D-10) is treated as a single sign for the purposes of this section.

Overhead signs shall provide a vertical clearance of not less than 17 feet over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not be greater than 1 foot in excess of the minimum design clearance of other structures. In special cases it may be necessary to reduce the clearance still further because of substandard dimensions in tunnels and other major structures such as double-deck bridges.

2A-24 Lateral Clearance

Signs should have the maximum practical lateral clearance from the edge of the traveled way for the safety of motorists who may leave the roadway and strike the sign supports. Advantage should be taken of existing guardrail, overcrossing structures and other conditions to minimize the exposure of sign supports to traffic. Otherwise, breakaway or yielding supports should be used.

Normally, signs should not be closer than 6 feet from the edge of the shoulder, or if none, 12 feet from the edge of the traveled way. In urban areas a lesser clearance may be used where necessary. A clearance of 1 foot from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb.

The minimum clearance outside the usable roadway shoulder for expressway signs mounted at the roadside or for overhead sign supports, either to the right or left side of the roadway, shall be 2 feet. This minimum clearance of 2 feet shall also apply outside of an unmountable curb. Where practicable, a sign should not be less than 10 feet from the edge of the nearest traffic lane. Large guide signs especially should be farther removed, preferably 30 feet or more from the nearest traffic lane. Lesser clearances, but not generally less than 6 feet, may be used on connecting roadways or ramps at interchanges.

Where an expressway median is 12 feet or less in width, consideration should be given to spanning both roadways without a center support. Butterfly-type signs and other overhead sign supports

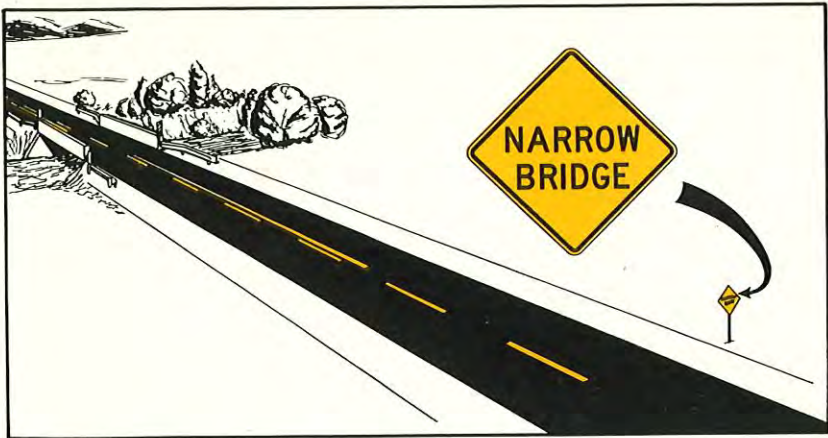


Figure 2-5. Typical applications of warning signs.

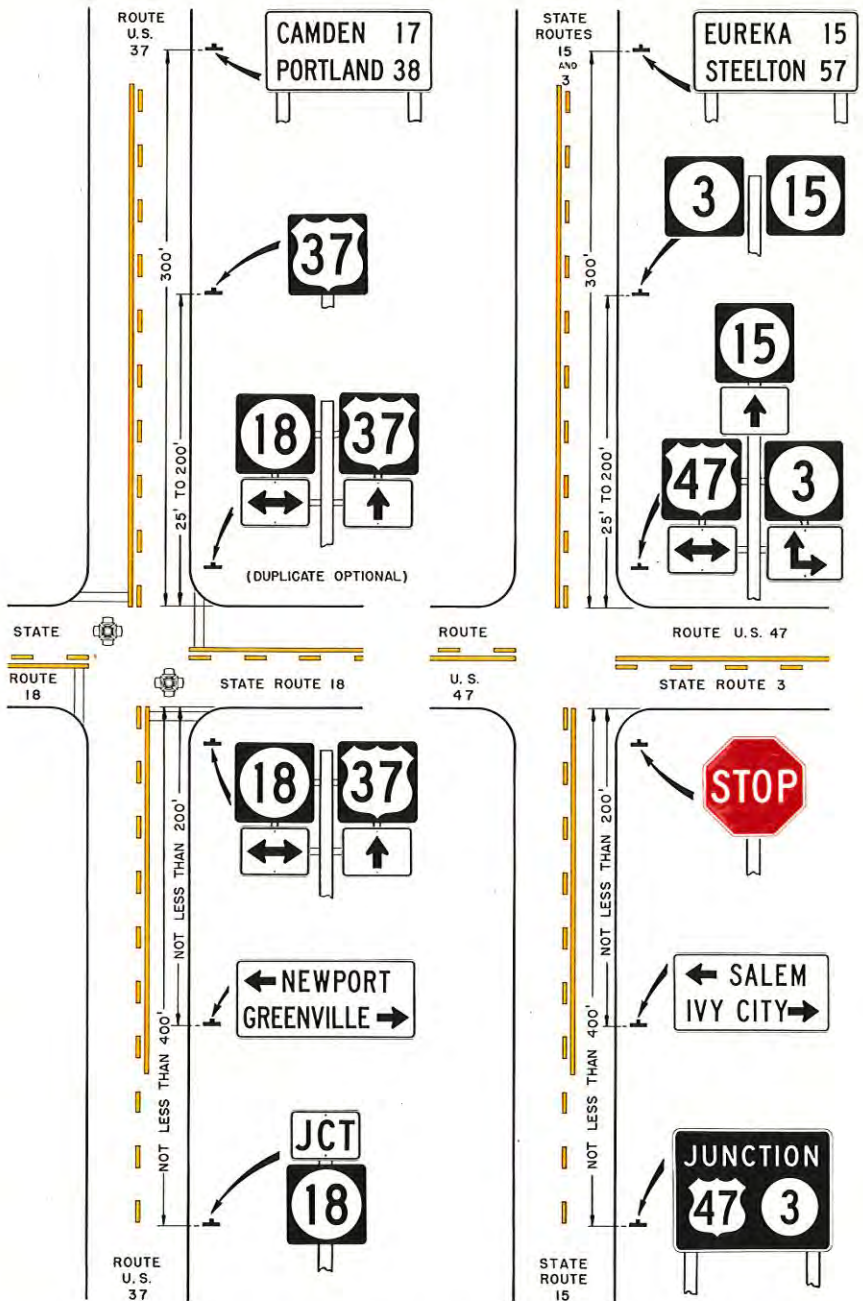


Figure 2-6a. Typical route markings at rural intersections (for one direction of travel only).

should not be erected in gores or other exposed locations. Where overhead sign supports cannot be placed a safe distance away from the line of traffic, or in an otherwise protected site, they should either be so designed as to minimize the impact forces, or otherwise protect motorists adequately by a physical barrier or guardrail of suitable design.

2A-25 Position of Signs

A warning sign is placed in advance of the condition to which it calls attention (fig. 2-5). A regulatory sign normally is placed where its mandate or prohibition applies or begins. Guide signs are placed, where needed, to keep drivers well informed as to the route to their destination. Figures 2-6a, 6b, 6c show the placement of intersection guide signs on other than expressways. Detailed specifications for sign locations are given in the sections of the Manual dealing with an individual sign or classes of signs.

2A-26 Erection

Normally, signs should be mounted approximately at right angles to the direction of, and facing, the traffic that they are intended to serve.

Where mirror reflection from the sign face is encountered in such degree as to reduce legibility, the sign should be turned slightly away from the road. At curved alignments, the angle of placement should be determined by the course of approaching traffic rather than by the roadway edge at the point where the sign is located. Sign faces normally are vertical, but on grades it may be desirable to tilt a sign forward or back from the vertical to improve the viewing angle.

2A-27 Posts and Mountings

Sign posts and their foundations and sign mountings shall be so constructed as to hold signs in a proper and permanent position, to resist swaying in the wind or displacement by vandalism.

Especially in rural areas, if roadside sign supports cannot be sufficiently distant (sec. 2A-24) from the pavement edge, sign supports should be of a suitable breakaway or yielding design. Concrete bases for sign supports should be flush with the ground level.

In some cases, especially in urban districts, signs can be correctly placed on existing supports used for other purposes, such as traffic signals, street lights, and public utility poles where permitted, thereby saving expense and minimizing sidewalk obstruction.

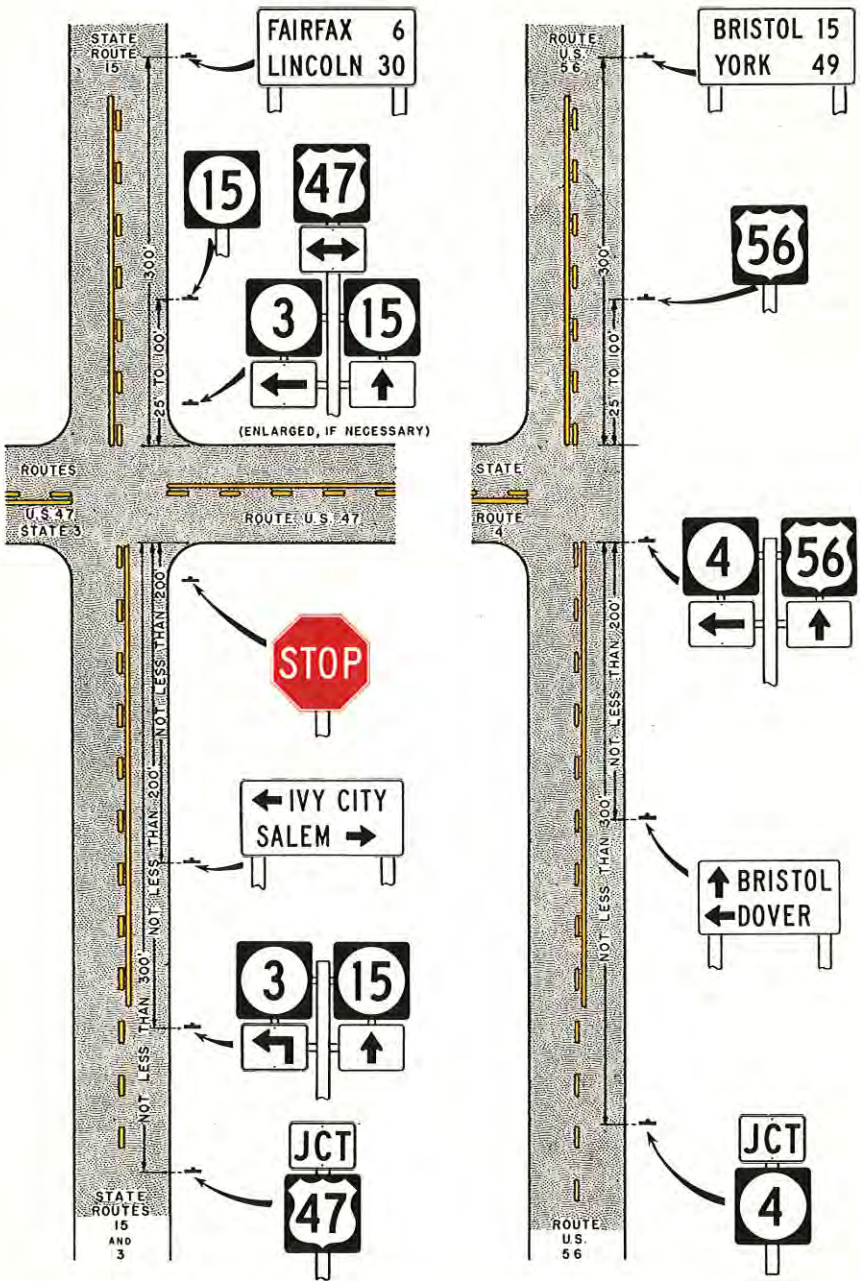


Figure 2-6b. Typical route markings at rural intersections (for one direction of travel only).

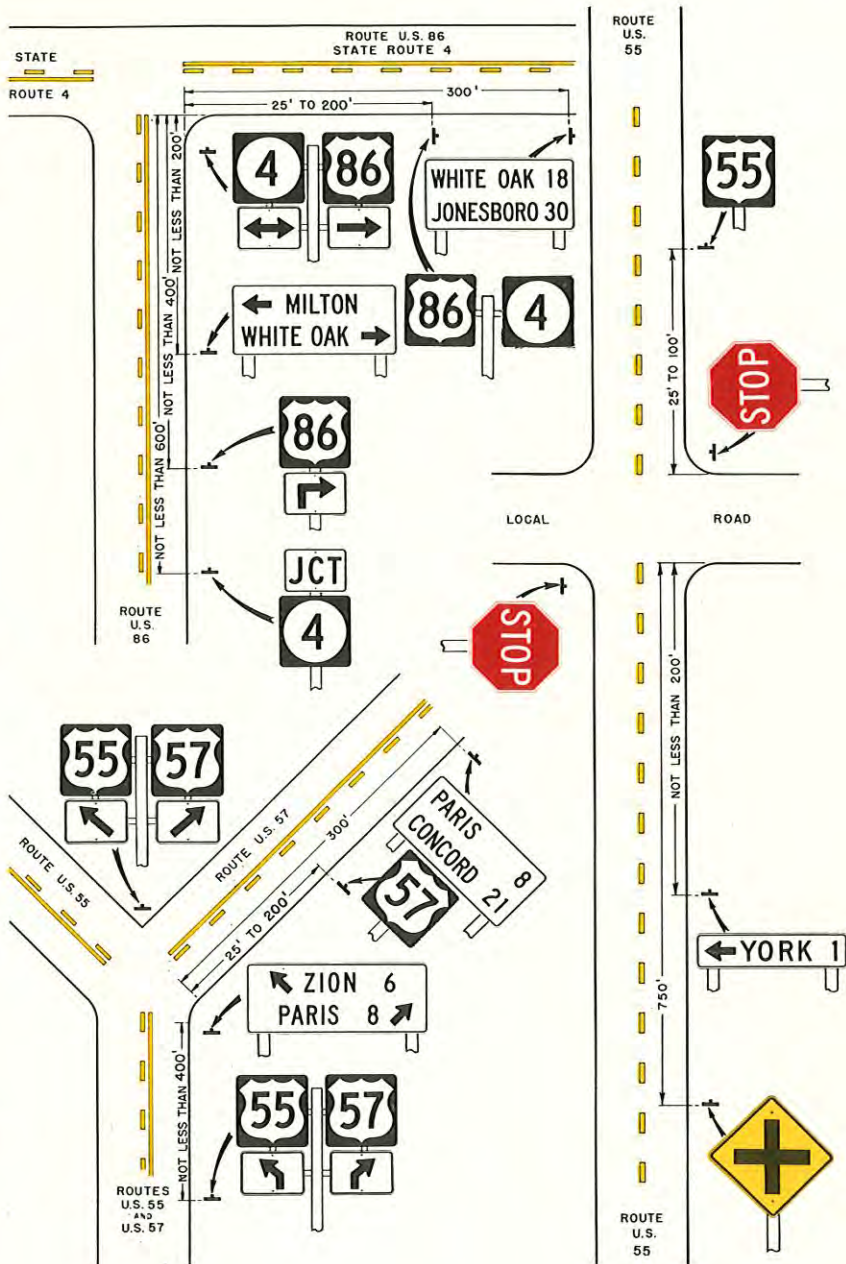


Figure 2-6c. Typical route markings at rural intersections (for one direction of travel only).

2A-28 Bridges for Sign Supports

An overcrossing structure will sometimes serve for the support of overhead signs, and under some circumstances, may be the only practical solution that will provide adequate viewing distance. Such use of a structure as a sign support will eliminate the need for the foundations and sign supports along the roadside. On an urban freeway where overhead crossings are closely spaced, for example, it may be feasible to place some signs on the bridges.

2A-29 Sign Materials

A variety of materials can be used effectively. However, it is recognized that technological progress may develop new and satisfactory or superior materials for highway signs, particularly in the fields of illumination and reflectorization. Nothing in this Manual should be interpreted to exclude any new material that meets the standard requirements for color and visibility.

2A-30 Maintenance

All traffic signs should be kept in proper position, clean and legible at all times. Damaged signs should be replaced without undue delay.

To insure adequate maintenance, a suitable schedule for inspection, cleaning and replacement of signs should be established. Employees of the highway department, police and other governmental employees whose duties require that they travel on the highways should be encouraged to report any damaged or obscured signs at the first opportunity.

Special attention and necessary action should be taken to see that weeds, trees, shrubbery and construction materials do not obscure the face of any sign.

A regular schedule of replacement of lighting elements for illuminated signs should be maintained.

B. REGULATORY SIGNS

2B-1 Application of Regulatory Signs

Regulatory signs inform highway users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent. These signs shall be erected wherever needed to fulfill this purpose, but unnecessary mandates should be avoided. The laws of many States specify that certain regulations are enforceable only when made known by official signs.

Some regulatory signs are related to operational controls but do not impose any obligations or prohibitions. For example, signs giving advance notice of or marking the end of a restricted zone are included in the regulatory group.

Regulatory signs normally shall be erected at those locations where regulations apply. The sign message shall clearly indicate the requirements imposed by the regulation and shall be easily visible and legible to the motorist concerned.

2B-2 Classification of Regulatory Signs

Regulatory signs are classified in the following groups:

1. Right-of-way series:
 - (a) STOP sign (sec. 2B-4 to 6)
 - (b) YIELD sign (sec. 2B-7 to 9)
2. Speed series (sec. 2B-10 to 14)
3. Movement series:
 - (a) Turning (sec. 2B-15 to 19)
 - (b) Alignment (sec. 2B-20 to 24)
 - (c) Exclusion (sec. 2B-25 to 27)
 - (d) ONE WAY (sec. 2B-28)
4. Parking series (sec. 2B-29 to 32)
5. Pedestrian series (sec. 2B-33 to 34)
6. Miscellaneous series (sec. 2B-35 to 43)

2B-3 Design of Regulatory Signs

Regulatory signs are rectangular, with the longer dimension vertical, and have black legend on a white background, except for those signs whose standards specify otherwise.

All regulatory signs shall be reflectorized or illuminated to show the same shape and color both by day and by night, unless excepted in the standards covering a particular sign or group of signs.



R1-1
30" x 30"



R1-3
12" x 6"



R1-4
18" x 6"

2B-4 Stop Sign (R1-1)

STOP signs are intended for use on roadways where traffic is required to stop.

The STOP sign shall be an octagon with white message and border on a red background. The standard size shall be 30 inches by 30 inches. Where greater emphasis or visibility is required, a larger size is recommended. On low-volume local streets and secondary roads with low approach speeds, a 24-inch by 24-inch size may be used.

At a multiway stop intersection (sec. 2B-6), a supplementary plate (R1-3) should be mounted just below each STOP sign. If the number of approach legs to the intersection is three or more, the numeral on the supplementary plate shall correspond to the actual number of legs, or the legend ALL-WAY (R1-4) may be used. The supplementary plate shall have white letters on a red background and shall have a standard size of 12 inches by 6 inches (R1-3) or 18 inches by 6 inches (R1-4).

A STOP sign beacon or beacons may be used in conjunction with a STOP sign as described in section 4E-4.

Secondary messages shall not be used on STOP sign faces.

2B-5 Warrants for Stop Sign

Because the STOP sign causes a substantial inconvenience to motorists, it should be used only where warranted. A STOP sign may be warranted at an intersection where one or more of the following conditions exist:

1. Intersection of a less important road with a main road where application of the normal right-of-way rule is unduly hazardous.
2. Street entering a through highway or street.
3. Unsignalized intersection in a signalized area.
4. Other intersections where a combination of high speed, restricted view, and serious accident record indicates a need for control by the STOP sign.

STOP signs should never be used on the through roadways of expressways. Properly designed expressway interchanges provide for the continuous flow of traffic, making STOP signs unnecessary even on the entering roadways. Where at-grade intersections are temporarily justified for local traffic in sparsely populated areas, STOP signs should be used on the entering roadways to protect the through traffic. STOP signs may also be required at the end of diverging roadways at the intersection with other highways not designed as expressways. In most of these cases, the speeds will not warrant any great increase in the sign sizes.

STOP signs shall not be erected at intersections where traffic control signals are operating. The conflicting commands of two types of control devices are confusing. If traffic is required to stop when the operation of the stop-and-go signals is not warranted, the signals should be put on flashing operation with the red flashing light facing the traffic that must stop.

Where two main highways intersect, the STOP sign or signs should normally be posted on the minor street to stop the lesser flow of traffic. Traffic engineering studies, however, may justify a decision to install a STOP sign or signs on the major street, as at a three-way intersection where safety considerations may justify stopping the greater flow of traffic to permit a left-turning movement.

For other than emergency purposes portable or part-time STOP signs shall not be used.

STOP signs should not be used for speed control.

2B-6 Multiway Stop Signs

The "Multiway Stop" installation is useful as a safety measure at some locations. It should ordinarily be used only where the volume of traffic on the intersecting roads is approximately equal. A traffic control signal is more satisfactory for an intersection with a heavy volume of traffic.

Any of the following conditions may warrant a multiway STOP sign installation (sec. 2B-4) :

1. Where traffic signals are warranted and urgently needed, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installation.

2. An accident problem, as indicated by five or more reported accidents of a type susceptible of correction by a multiway stop installation in a 12-month period. Such accidents include right-and left-turn collisions as well as right-angle collisions.

3. Minimum traffic volumes :

- (a) The total vehicular volume entering the intersection from all approaches must average at least 500 vehicles per hour for any 8 hours of an average day, and

- (b) The combined vehicular and pedestrian volume from the minor street or highway must average at least 200 units per hour for the same 8 hours, with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the maximum hour, but

- (c) When the 85-percentile approach speed of the major street traffic exceeds 40 miles per hour, the minimum vehicular volume warrant is 70 percent of the above requirements.

2B-7 Yield Sign (R1-2)

The YIELD sign assigns right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a YIELD sign need stop only when necessary to avoid interference with other traffic that is given the right-of-way.



R1-2
36" x 36" x 36"

The YIELD sign shall be a downward pointing, equilateral triangle having a red border band and a white interior and the word YIELD in red inside the border band; the border band to be 5 inches for the 36-inch sign and 6 inches for the 48-inch sign.

2B-8 Warrants for Yield Signs

The YIELD sign may be warranted:

1. On a minor road at the entrance to an intersection where it is necessary to assign right-of-way to the major road, but where a stop is not necessary at all times, and where the safe approach speed on the minor road exceeds 10 miles per hour.
2. On the entrance ramp to an expressway where an acceleration lane is not provided.
3. Within an intersection with a divided highway, where a STOP sign is present at the entrance to the first roadway and further control is necessary at the entrance to the second roadway, and where the median width between the two roadways exceeds 30 feet.
4. Where there is a separate or channelized right-turn lane, without an adequate acceleration lane.
5. At any intersection where a special problem exists and where an engineering study indicates the problem to be susceptible to correction by use of the YIELD sign.

YIELD signs should not ordinarily be placed to control the major flow of traffic at an intersection. They should not be erected on the approaches of more than one of the intersecting streets or highways or used at any intersection where there are STOP signs on one or more approaches, except, under special circumstances, to provide minor movement control within complex intersections.

YIELD signs should not be used on the through roadways of expressways. They may be used on an entering roadway without an adequate acceleration lane, but in a well designed interchange, the sign would interfere with the free merging movement, and it should not be used under those circumstances.

2B-9 Location of Stop Sign and Yield Sign

A **STOP** sign should be erected at the point where the vehicle is to stop or as near thereto as possible, and may be supplemented with a Stop line and/or the word **STOP** on the pavement, as shown in figure 2-2. A **YIELD** sign should be erected in the same manner, at the point where the vehicle is to stop if necessary to yield the right-of-way. Where there is a marked crosswalk on the pavement, the sign should be erected approximately 4 feet in advance of the crosswalk line nearest to approaching traffic.

Where only one sign, **STOP** or **YIELD**, is used, it shall be on the right-hand side of the traffic lane to which it applies. At an intersection where a wide throat exists on the signed approach, observance of the sign may be improved by the erection of an additional sign on the left side of the approach road, and by the use of a Stop line. Where two lanes of traffic are subject to the **STOP** sign, a second sign should be placed where it is visible to traffic in the inner lane. At certain channelized intersections, the additional sign may be effectively placed on a channelizing island. In no instance shall one **STOP** or **YIELD** sign be mounted above another on the same post.

Where two roads intersect at an acute angle, the **STOP** or **YIELD** sign should be positioned at an angle, or shielded, so that the message is out of view of traffic to which it does not apply.

In the event the visibility of a **STOP** sign or a **YIELD** sign at any location is restricted, the sign shall be located as specified, and a **STOP AHEAD** sign (sec. 2C-14) or a **YIELD AHEAD** sign (sec. 2C-15) shall be erected in advance of the **STOP** or **YIELD** sign.

Figures 2-2, 2-6a, 2-6b, & 2-6c show typical **STOP** and **YIELD** sign installations.

2B-10 Speed Limit Sign (R2-1)

The Speed Limit sign shall display the limit established by law, or by regulation, after an engineering and traffic investigation has been made in accordance with established traffic engineering practices. The speed limits shown shall be in multiples of 5 miles-per-hour.

In order to determine the proper numerical value for a speed zone on the basis of an engineering and traffic investigation the following factors should be considered :

1. Road surface characteristics, shoulder condition, grade, alignment and sight distance.
2. The 85-percentile speed and pace speed.
3. Roadside development and culture, and roadside friction.
4. Safe speed for curves or hazardous locations within the zone.
5. Parking practices and pedestrian activity.
6. Reported accident experience for a recent 12-month period.

Two types of speed limit signs may be used: One to designate passenger car speeds including any nighttime information or minimum speed limit that might apply, and the other to show any special speed limits for buses and trucks. No more than three speed limits should be displayed on any one speed limit sign or assembly. Where a special speed limit applies to trucks or other vehicles, the legend TRUCKS 40, or such similar message as is appropriate, shall be



R2-1
24" x 30"



R2-2
24" x 24"

shown below the standard message or on a separate plate (R2-2). When used independently, the Truck Speed sign should carry a reference to SPEED or MPH.

Minimum speeds shall be displayed only in combination with the posted speed limit (sec. 2B-12).

Advisory Speed signs are treated under section 2C-36.

The standard Speed Limit sign shall be 24 inches by 30 inches. On expressways the sign should be at least 36 inches by 48 inches, with 48 inches by 60 inches prescribed for use on freeways.

2B-11 Night Speed Sign (R2-3)

Where different speed limits are prescribed for day and night, both the limits shall be posted. This may be done in either of two ways:

1. Immediately below the standard Speed Limit sign (R2-1) or combined with it, a Night Speed sign (R2-3) carrying the legend NIGHT 45 (or other suitable numerical limit) may be erected. In

this case the numerals in the Night Speed sign and only the words SPEED LIMIT in the standard sign, should be reflectorized. As a special but logical exception to the general color scheme, the Night Speed sign should have its legend in white upon a black background.

2. A changeable message sign may be used, so that only the appropriate regulation is visible at a given time. The sign may have interchangeable panels, or reflectorization of the nighttime speed superimposed over the unreflectorized numerals of the daytime speed, to permit only the nighttime speed to become legible in the beam of motor-vehicle headlamps at night.



R2-3
24" x 24"

2B-12 Minimum Speed Sign (R2-4)

Where an engineering and traffic investigation shows that slow speeds on a highway consistently impede the normal and reasonable movement of traffic, signs may be used to post a minimum legal



R2-4
24" x 30"



R2-4a
24" x 48"

speed. Driving slower than the minimum limit is illegal except when necessary for safe operation or in compliance with the law. The minimum speed shall be displayed only in combination with the posted speed limit, and if desired, these two signs may be combined (R2-4a). The Minimum Speed sign shall have a standard, and minimum, size of 24 inches by 30 inches.

2B-13 Location of Speed Limit Sign

Speed Limit signs, indicating speed limits for which posting is required by law, shall be located at the points of change from one speed limit to another. These signs shall not be erected until the speed limits are approved and officially authorized.

At the end of the section to which a speed limit applies, a Speed Limit sign showing the next speed limit shall be erected. Additional signs shall be installed beyond major intersections and at other locations where it is necessary to remind motorists of the limit that is applicable.

The Speed Zone Ahead sign (sec. 2B-14) may be used to give advance notice of a speed zone with a lower limit.

In rural districts on U.S. and other State numbered routes, Speed Limit signs indicating the statutory speed limits shall be erected at entrances to the State and at boundaries of metropolitan areas. A special oversize sign is often desirable at these locations.

2B-14 Sign for Reduced Speed Ahead (R2-5)

This sign should be used in rural areas to inform the motorist of a reduced speed zone when an advance notice is needed to comply with the speed limit posted ahead. The sign is not ordinarily needed in urban areas where speeds are relatively low.

This sign shall always be followed by a Speed Limit sign erected at the beginning of the zone where the altered speed limit applies.

This sign shall have a standard size of 24 inches by 30 inches. It shall, however, be of the same size as the Speed Limit sign at the



R2-5a
24" x 30"



R2-5b
24" x 30"



R2-5c
24" x 30"

beginning of the speed zone, shall be erected in the same manner, and shall display one of the three illustrated legends.

2B-15 Turn Prohibition Signs (R3-1 to 3)

Turn Prohibition signs should be used to indicate the turns that are prohibited or restricted at a particular intersection.

The standard, and minimum, size of the NO RIGHT TURN sign (R3-1), the NO LEFT TURN sign (R3-2), and the NO TURNS sign (R3-3) shall be 24 inches by 24 inches.



R3-1
24" x 24"
24" x 18"



R3-1a
24" x 30"



R3-3
24" x 24"

Turn Prohibition signs should be placed where they will be most easily seen by drivers intending to turn. The No Right Turn sign shall be placed at the near right-hand corner of the intersection. Where No Left Turn or No Turns signs are required, two shall be used, one at the near right-hand corner and one at the far left-hand corner, facing traffic approaching the intersection. Where there is a traffic signal on the far right corner, the sign on the right-hand side should be placed near that signal.

If advance signs are used, care should be taken that no alley or public driveway exists between them and the intersection where the turning movement is prohibited. At an intersection with a one-way street, whether signalized or not, the ONE WAY sign (sec. 2B-28) shall be used, and may be supplemented by the Turn Prohibition sign (fig. 2-3). A Turn Prohibition sign is not needed at a ramp entrance to an expressway where the design is such as to indicate clearly the one-way traffic movement on the ramp. The DO NOT ENTER sign (sec. 2B-25) will serve in lieu of the Turn Prohibition

sign where it is necessary to emphasize the one-way traffic movement on the ramp.

When the movement restriction applies during certain periods only, the use of Turn Prohibition signs calls for special treatment. The following alternatives are listed in order of preference:

1. Variable message signs or internally illuminated signs that are lighted and made legible only during the restricted hours, particularly desirable at signalized intersections.

2. Permanently mounted signs incorporating a supplementary legend showing the hours during which the prohibition is applicable.

3. Portable signs off the roadway at each corner of the intersection where required, put in place under police supervision only when applicable and removed at other hours.

The appropriate word message, NO RIGHT TURN (R3-1a) or NO LEFT TURN (R3-2a), on a 24" x 30" panel may be used as an alternate.

2B-16 U-Turn Prohibition Sign (R3-4)

The NO U TURN sign is intended for use at or between intersections to indicate locations where U turns are prohibited. The sign shall have a standard size of 24 inches by 24 inches.

The word message, NO U TURN (R3-4a), on a 24" x 30" panel may be used as an alternate.



R3-4
24" x 24"
24" x 18"



R3-4a
24" x 30"

2B-17 Lane-Use Control Signs (R3-5 to 9)

Lane-Use Control signs shall be used where turning movements are required or where unconventional turning movements are per-

mitted from specific lanes at an intersection. The standard size of these signs shall be 30 inches by 36 inches when mounted overhead, and 30 inches by 30 inches when post mounted. Signs for overhead mounting shall be mounted over the lanes to which they apply. The Mandatory Movement sign (R3-5) shall show a single arrow and the regulatory word message ONLY. The optional movement sign (R3-6) shall show a straight-through and a curved arrow with the lower ends of their shafts superimposed, to indicate that either of the movements symbolized is permissible. The letters "OK" may be added to the legend of the R3-6 sign. The optional movement sign (R3-6) shall not be used alone to effect a turn prohibition.



R3-5
30" x 36"



R3-6
30" x 36"

The mandatory turn sign (R3-7) designed for post mounting shall carry the message Right (or Left) Lane Must Turn Right (or Left).



R3-7
30" x 30"



R3-8
30" x 30"



R3-9
24" x 30"

Double-turn signs for post mounting may be needed at such locations as at the right curb (for double right turns) or on the left side of a one-way street or on the median of a divided highway (for

double left turns). The post-mounted double-turn signs (R3-8) should carry, side by side on the same plate, two arrow symbols similar to the designs for the overhead signs. The letters OK may be added to the double turn portion of the legend for the R3-8 sign.

The Center Lane-Left Turn Only sign (R3-9) shall be used where a lane in the center of a highway is reserved for the exclusive use of left-turning vehicles in either direction and is not used for passing and overtaking. Pavement markings shall be used with the sign (sec. 3B-12). The sign should be mounted over the lane to which it applies.

2B-18 Application of Lane-Use Control Signs at Intersections

Lane-Use Control signs shall be used at intersections whenever it is desired to require vehicles in certain lanes to turn, or to permit turns from an adjacent lane.

Lane-use controls permitting left (or right) turns from two (or more) lanes are normally warranted whenever the turning volume exceeds the capacity of one turning lane, and when all movements can be accommodated in the lanes available to them.

When multiple-lane left turns are to be permitted at signalized intersections, special signal phasing should be used to allow the turning movements without interference from opposing or cross traffic.

2B-19 Location of Lane-Use Control Signs

Overhead Lane-Use Control signs are preferred because they can be placed over the lanes to which they apply. This type of control, and particularly the multiple-lane turn, occurs where volumes are high and an overhead installation can be justified.

When post-mounted Lane-Use Control signs are used, one sign should be placed at the intersection. A second Lane-Use Control sign should be placed at an adequate distance in advance of the intersection so that motorists can select the appropriate lane before reaching the ends of the lines of waiting vehicles. Pavement markings (sec. 3B-18) may be used to supplement post-mounted signs and should be used with mandatory turn signs.

2B-20 Do Not Pass Sign (R4-1)

The DO NOT PASS sign may be used on a two- or three-lane road at the beginning of, and at intervals within, a zone through which restricted sight distance or other condition makes overtaking and passing hazardous. Where standard pavement markings (sec. 3B-3) are present, the sign need not be used. However, the sign

may be used in addition to the pavement markings to emphasize the restriction on passing.

The standard DO NOT PASS sign shall be 24 inches by 30 inches in size, with a minimum size for minor roads of 18 inches by 24 inches.

Because a driver about to pass a vehicle ahead often has only a restricted view to the right, an additional sign on the left-hand side of the roadway may be desirable. The NO PASSING ZONE sign (sec. 2C-39) may be used as a supplemental sign on the left-hand side of a two-lane road.

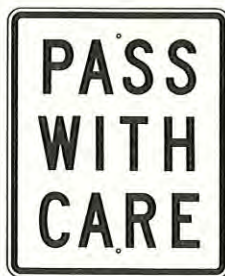
Standards for determining the location and extent of no-passing zones are set forth in connection with pavement markings through such zones (secs. 3B-4, 5).



R4-1
24" x 30"

2B-21 Pass With Care Sign (R4-2)

The PASS WITH CARE sign should be used at the end of a no-passing zone where a DO NOT PASS sign has been erected at the beginning of the zone. It shall be of the same size and erected in the same manner as the DO NOT PASS sign.



R4-2
24" x 30"

2B-22 Slower Traffic Keep Right Sign (R4-3)

The SLOWER TRAFFIC KEEP RIGHT sign may be used on multiple-lane roadways to reduce unnecessary weaving. It should be erected just beyond the beginning of a multiple-lane pavement, and at selected locations on the median strip of a divided highway where there is a tendency on the part of the motorist to drive in the left-hand lane (or lanes) below the normal speed of traffic. It should not be used on the approach to an interchange or through an interchange area.

This sign shall have a standard, and minimum, size of 24 inches by 30 inches. Because it is not used on secondary roads, no small design is provided. On expressways the sign should be at least 36 inches by 48 inches, with 48 inches by 60 inches prescribed for freeways.



R4-3
24" x 30"

2B-23 Signs for Uphill Traffic Lanes (R4-5, R4-6)

Where an extra lane has been provided on an upgrade for slow-moving traffic, it should be preceded by a sign directing such traffic into this "climbing" lane. The SLOWER TRAFFIC KEEP RIGHT sign (sec. 2B-22) is applicable for this purpose, or more specific messages such as TRUCKS USE RIGHT LANE (R4-5) may be used. The standard, and minimum, size of these signs shall be 24 inches by 30 inches.

In advance of the beginning of the climbing lane a sign, TRUCK LANE (500) FEET (R4-6), may be erected, of the same size as the sign at the beginning of the climbing lane. The distance shown should approximate that of the actual location of the sign.

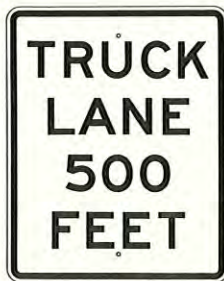
In advance of the end of the climbing lane, a Pavement Width Transition warning sign should be erected (sec. 2C-18). This is particularly important, as the end of the climbing lane will normally

be concealed beyond the crest of the grade. A duplicate sign on the left of the roadway is also desirable to warn the faster traffic, as the sign on the right may be obscured by the slower moving trucks.

Pavement markings should clearly indicate how the climbing lane is designed to operate.



R4-5
24" x 30"



R4-6
24" x 30"

2B-24 Keep Right Sign (R4-7)

The Keep Right sign should be used within and at the ends of medians, parkways, loading islands, and refuge islands, at traffic islands, and at underpass piers, where traffic is required to keep to the right. The word message KEEP RIGHT, with an arrow, on a 24" x 30" panel may be used as an alternate for the R4-7 sign.



R4-7
24" x 30"
24" x 18"



R4-7a
24" x 30"



R4-7b
24" x 30"



R4-8
24" x 30"
24" x 18"

The Keep Right sign shall have a standard size of 24 inches by 30 inches. On expressways the sign should be at least 36 inches by 48 inches, with 48 inches by 60 inches prescribed for use on freeways. A smaller size of 18 inches by 24 inches is permissible for use on narrow medians and at median openings to serve entering cross traffic and to remind through traffic of the regulation.

A certain amount of flexibility must be allowed in the mounting height for Keep Right signs. Where the obstruction is in or so near the lane of traffic that the sign at a normal minimum height may be obscured by vehicles, a second sign of the same design may be mounted directly above the standard sign with its bottom edge at a height of 8 to 10 feet above the pavement. In this case the lower sign may be placed somewhat below the normal minimum height.

On a median, the Keep Right sign should be mounted not more than 50 feet beyond the approach end of the island. On a pedestrian island or intersection channelizing island it should be mounted at the approach end or as close thereto as practicable. The sign should be mounted on the face of or just in front of a pier or other obstruction in the center of the roadway. Where appropriate, a Keep Left sign (R4-8) may be used (sec. 5E-2).

2B-25 Do Not Enter Sign (R5-1)

To prohibit traffic from entering a restricted road section the DO NOT ENTER sign should be conspicuously placed in the most appropriate position at the end of a one-way roadway or ramp. The sign

should normally be mounted on the right-hand side of the roadway, facing traffic entering the roadway or ramp in the wrong direction. However, a second sign on the left-hand side of the roadway may be justified, particularly where traffic may be approaching in a turn.

The DO NOT ENTER sign shall be a 30-inch white square on which is inscribed a 29-inch diameter red circle, with a white band 5 inches in width placed horizontally across the center of the circle. The legend DO NOT ENTER shall appear in white letters with the words DO NOT above the band and ENTER below the band. Larger sizes are prescribed for use on major streets or on expressways with one-way ramp or roadway connections.



R5-1
30" x 30"

2B-26 Wrong Way Sign (R5-9)

The WRONG WAY sign (R5-9) may be used as a supplement to the DO NOT ENTER sign (R5-1) where an exit ramp intersects a crossroad or a crossroad intersects a divided highway in a manner that may invite wrong-way entry.

The sign should be placed at a location along the exit ramp or the divided roadway farther from the crossroad than the DO NOT ENTER sign.



R5-9
36" x 24"

2B-27 Selective Exclusion Signs

The laws of most States permit the State or local authority having jurisdiction to exclude trucks or other commercial vehicles from any

designated highway where signs have been placed giving this notice. Sign legends should be developed to meet requirements established by statute or ordinance. The No Trucks symbol (R5-2), COMMERCIAL VEHICLES EXCLUDED (R5-4), and TRUCKS (VEHICLES) WITH LUGS PROHIBITED (R5-5) are suggested as suitably specific legends.



R5-2
24" x 24"
24" x 18"



R5-2a
24" x 24"



R5-4
24" x 30"



R5-5
24" x 30"

The word legend NO TRUCKS (R5-2a) on a 24" x 24" panel may be used as an alternate for the R5-2 sign.

Most States provide that the proper authority may exclude pedestrians, bicycles, or other type traffic and shall erect signs setting forth such restrictions. To be effective such signs must clearly indicate the type of traffic that is admitted or the type that is excluded. Typical exclusion messages include PEDESTRIANS PROHIBITED (R5-3), NO BICYCLES (R5-6), NONMOTORIZED

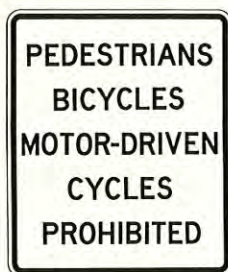
TRAFFIC PROHIBITED (R5-7), MOTOR-DRIVEN CYCLES PROHIBITED (R5-8) or an appropriate combination or grouping of these legends into a single sign, such as PEDESTRIANS BICYCLES MOTOR-DRIVEN CYCLES PROHIBITED or PEDESTRIANS AND BICYCLES PROHIBITED (R5-10).



R5-3
24" x 12"



R5-6
24" x 24"
24" x 18"



R5-10
30" x 36"



R5-10
30" x 18"

If an exclusion is to be governed by vehicle weight, a Weight Limit Sign (sec. 2B-39) rather than an Exclusion sign should be used.

Because of the variety of possible messages for these signs, it is not practicable to fix standard sizes for them as a class. In all cases the lettering should be large enough to give adequate legibility. They should be conspicuously placed at all entrances to the restricted roadway.

The Exclusion sign should be placed on the right-hand side of the roadway approximately 25 feet from the intersection so as to be

clearly visible to all drivers and others turning into the roadway which has the exclusion. A supplementary sign may be necessary on the left-hand side of the restricted roadway.

A **PEDESTRIANS PROHIBITED (R5-3)** sign should be used at interchanges or elsewhere where pedestrians can enter the expressway right-of-way and endanger themselves or others, particularly where they attempt to cross the roadways. The sign may also be used at underpasses or elsewhere where safe pedestrian facilities are not provided. The sign should be erected wherever it can be most effective. Because of the length of the words constituting its legend, a horizontal panel is warranted, 24 inches by 12 inches in size. As an exception to the general rule (sec. 2B-3), it need not be reflectorized or illuminated.

2B-28 One Way Sign (R6-1, R6-2)

The **ONE WAY** sign shall be used when required to indicate streets or roadways upon which vehicular traffic is allowed to travel in one direction only. The sign shall be either (a) a white arrow, right or left, on a black horizontal rectangle of a standard, and minimum, size of 36 inches by 12 inches with the words **ONE WAY** centered in the arrow (**R6-1**); or (b) a vertical rectangle of a standard, and minimum, size of 18 inches by 24 inches with black lettering and a right or left arrow on a white background (**R6-2**). The vertical design has advantages where lateral space is limited.

One Way signs shall be placed on the near right-hand and the far left-hand corners of the intersection so as to face traffic entering or crossing the one-way street (fig. 2-3). Where the intersection is signalized, the signs should be placed near the appropriate signal faces. One Way signs should also be placed parallel to the one-way street directly opposite the exits from alleys and other public ways. A One Way sign should always be used, where applicable, and may be supplemented by a Turn Prohibition Sign (sec. 2B-15).



R6-1
36" x 12"



R6-2
18" x 24"

One Way signs are not ordinarily needed on the one-way roadways of divided expressways, where the design of interchanges indicates the direction of traffic on the separate roadways.

2B-29 Urban Parking and Stopping Signs (R7 Series)

Parking signs and other signs governing the stopping and standing of vehicles cover a very wide variety of regulations and only general specifications can be laid down here. Typical examples are as follows:

NO PARKING ANY TIME (R7-1)

NO PARKING 8:30 AM to 5:30 PM (R7-2)

NO PARKING EXCEPT SUNDAYS AND HOLIDAYS (R7-3)

NO STOPPING OR STANDING (R7-4)

ONE HOUR PARKING 9 AM-7 PM (R7-5)

NO PARKING LOADING ZONE (R7-6)

NO PARKING BUS STOP (R7-7)



R7-1
12" x 18"



R7-5
12" x 18"



R7-107
12" x 18"



R7-108
12" x 18"



R7-201
12" x 6"

Many other wordings will be found necessary to fit local conditions. To minimize the number of parking signs, blanket regulations that apply to a given district may, if legal, be posted at municipal boundary lines. School area parking signs are treated in Part VII of this Manual.

The legend on parking signs shall state whatever regulations apply, but the signs shall conform to the standards of shape, color, location and use. Generally, parking signs should display such of the following information as is appropriate, from top to bottom of the sign, in the order listed :

1. Restriction or prohibition.
2. Time of day it is applicable, if not at all hours.
3. Days of week applicable, if not every day.

In addition there should be a single-headed arrow pointing in the direction the regulation is in effect, if the sign is at the end of a zone, or a double-headed arrow pointing both ways, if the sign is at an intermediate point in a zone. As an alternate to the arrow, if the signs are posted facing traffic at an angle of 90 degrees to the curb line, there may be included on the sign, or on a separate plate below the sign, such legend as **HERE TO CORNER**, **HERE TO ALLEY**, **THIS SIDE OF SIGN**, or **BETWEEN SIGNS**.

Where parking is prohibited at all times or at specified times, parking signs shall have red letters and border on a white background (Parking Prohibition signs). Where only limited-time parking or parking in a particular manner are permitted, the signs shall have green letters and borders (Parking Restriction signs).

For emphasis the word **NO** or the numeral showing the time limit in hours or minutes may be in a reversed color arrangement in the upper left-hand corner of the sign, i.e., in white on a rectangular area of red or green (R7-107, 108). This design should be confined to signs using the word **PARKING** rather than **STOPPING** or **STANDING** so that the proper size and series of letters need not be sacrificed.

Where parking is prohibited during certain hours and permitted under a time limit at other periods of the day, two parking signs should ordinarily be used, the red above the green. As an alternative both messages, in different colors may be used on a single plate, with the sign lengthened vertically if necessary.

On urban streets parking signs shall have a standard, and minimum, size of 12 inches by 18 inches and need not be reflectorized.

At the transition point between two parking zones it may be advantageous to use, instead of two signs, a single sign 21 inches by 18 inches. This is in effect two standard signs mounted side by side. Such a sign should display a right and a left arrow pointing in the directions that the respective restrictions apply.

Where it is essential that all traffic lanes be kept open for moving traffic, some city authorities make it a practice to tow away illegally parked vehicles. To make the parking regulations more effective and to improve public relations by giving a definite warning, a sign reading TOW-AWAY ZONE (R7-201) may be appended to, or incorporated in, any parking prohibition sign. It should have red legend on a white background.

Where special parking restrictions are imposed during heavy snowfall, Snow Emergency signs may be erected. The legend will vary according to the regulations, but the signs shall be vertical rectangles, having a white background with the upper part of the plate a red background.

2B-30 Placement of Urban Parking Signs

Parking signs with arrows are used to indicate the extent of the restricted zones. The signs should be set at an angle of not less than 30 nor more than 45 degrees with the line of traffic flow to be visible to approaching traffic.

Care should be exercised to see that the single arrows point in the proper direction to indicate the regulated zone. Where the zone is unusually long, signs showing a double arrow are desirable at intermediate points within the zone.

If the signs are mounted at an angle of 90 degrees to the curb line, two signs shall be mounted back to back at the transition point between two parking zones, each with the appended plate reading THIS SIDE OF SIGN. At intermediate points within a zone, a single sign without any arrow or appended plate should be used, facing in the direction of approaching traffic. Otherwise the standards of placement should be the same as for signs using directional arrows.

2B-31 Parking Prohibition Signs in Rural District (R8-1, 2, 3, 5, 6)

In rural districts, special parking prohibition signs may be used to emphasize that no person shall stop, park, or leave standing any vehicle on the paved or traveled part of the highway. Rural parking prohibition signs shall have a red legend on a white background.

The legend on rural parking signs must be appropriate to the restrictions imposed. The legend NO PARKING ON PAVEMENT (R8-1) is generally suitable. Where a roadway has paved shoulders, the NO PARKING EXCEPT ON SHOULDER (R8-2) is less likely to cause confusion. If necessary, the word STOPPING may be substituted for PARKING (R8-5). The simple legend, NO PARKING (R8-3) prohibits any parking along a given high-

way. However, if the restriction applies to a limited area or zone, the limits of the zone should be shown by arrows or supplemental plates as used on urban parking signs. If necessary, the word STOPPING (R8-6) may be substituted for PARKING.

The standard size for rural parking signs shall be 24 inches by 30 inches. On secondary roads a smaller size of 18 inches by 24 inches is permitted. Expressway parking signs should be at least 36 inches by 48 inches.



R8-1
24" x 30"



R8-5
24" x 30"



R8-2
24" x 30"



R8-6
24" x 30"



R8-3
24" x 30"

2B-32 Emergency Parking Signs (R8-4, 7)

Stopping of vehicles on expressways can be exceedingly hazardous. If an emergency stop is necessary, it should be made on the shoulder, well off the pavement. Except where adequate paved turnouts are provided, the road shoulders should be reserved for emergency use by vehicles that must leave the roadway to stop because of mechanical breakdown, tire trouble, lack of fuel, or other emergencies involving the vehicles or their occupants.

The **EMERGENCY PARKING ONLY** sign (R8-4) may be used on expressways a short distance beyond an interchange entrance and at random intervals as needed, particularly where scenic or other attractions create a tendency to stop temporarily, and no turnout or rest areas have been provided. If necessary the word **STOPPING** (R8-7) may be substituted for **PARKING**. These signs are designed as horizontal rectangles as shown below and shall have a black legend on a white background. A size of 48 inches by 36 inches is prescribed for use on freeways.



R8-4
30" x 24"



R8-7
30" x 24"

2B-33 Walk on Left and No Hitchhiking Signs (R9-1, 4)

The pedestrian sign **WALK ON LEFT FACING TRAFFIC** may be used to encourage safer pedestrian habits on rural highways where no sidewalks are provided. This sign shall be in only one standard size of 18 inches by 24 inches, and need not be reflectorized. It should be erected on the right-hand side of the road where pedestrians must walk on the pavement or road shoulder in the absence of pedestrian pathways or sidewalks.



R9-1
18" x 24"



R9-4
18" x 24"

The **NO HITCHHIKING** sign may be used to post prohibition against standing in the roadway for the purpose of soliciting a ride.

The sign shall be in only one standard size of 18 inches by 24 inches. It may be erected at locations where hitchhiking has been observed contrary to law.

2B-34 Pedestrian Crossing Signs (R9-2, R9-3)

Pedestrian Crossing signs may be used selectively to aid in limiting pedestrian crossing to safe places. They will ordinarily be required only in urban areas and, when used, shall be erected to face the traffic for which they are intended. The messages shown below are typical:



R9-2
12" x 18"



R9-3
12" x 18"

The CROSS ONLY AT CROSS WALKS sign (R9-2) may be used, where crosswalks are clearly defined, to discourage jay-walking or unauthorized crossing. The NO PEDESTRIAN CROSSING sign (R9-3) may be used to prohibit pedestrians from crossing a roadway at a point which is considered to be hazardous, especially in front of a school or other public building where a crossing is not designated.

Pedestrian Crossing signs (R9-2 and R9-3) shall have a standard size of 12 inches by 18 inches and need not be reflectorized.

2B-35 Traffic Signal Signs (R10-1 to 4)

To supplement traffic signal control, auxiliary signs of the type illustrated are often desirable or necessary for the instruction of pedestrians and drivers.

Among the traffic signal instruction signs applicable to pedestrians are those shown below. These signs (R10-1, 2, 3, and 4) need not be reflectorized.



R10-1
12" x 18"



R10-2
12" x 18"



R10-3
9" x 12"



R10-4
9" x 12"



R10-5
12" x 18"

Permissible as an alternate message for the Pedestrian Actuated Signal sign (R10-3, R10-4) is the legend TO CROSS STREET (arrow) PUSH BUTTON WAIT FOR GREEN (WALK) SIGNAL (R10-3a, R10-4a).

The Pedestrian Actuated Signal sign shall be 9 inches by 12 inches in size and shall be mounted immediately above or incorporated in the pedestrian push-button unit (sec. 4D-6).

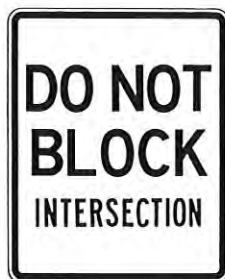
Signal instruction signs may be needed at certain locations to clarify signal control. Among the legends for this purpose are LEFT ON ARROW ONLY (R10-5), or LEFT (RIGHT) TURN SIGNAL (R10-10) for compliance with certain turn signals, STOP HERE ON RED (R10-6) for observance of signal limit lines, DO NOT BLOCK INTERSECTION (R10-7) for avoidance of traffic obstructions, USE LANE(S) WITH GREEN ARROW (R10-8) for obedience to lane-direction control signals and RIGHT TURN

ON RED AFTER STOP (R10-9) to permit a right turn on a red signal after stopping.

Where improved utilization of progressive signal systems is desired, the Traffic Signal Speed sign (sec. 2D-49) should be used.



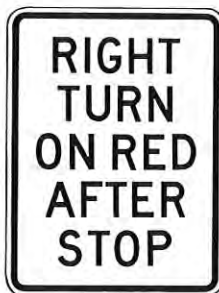
R10-6
24" x 36"



R10-7
24" x 30"



R10-8
24" x 30"



R10-9
18" x 24"



R10-10
24" x 30"

2B-36 Keep Off Median Sign (R11-1)

The Keep Off Median sign is intended for use where driving into or parking on the median is prohibited.

The KEEP OFF MEDIAN sign shall have a standard, and minimum, size of 24 inches by 30 inches. On expressways it should be at least 36 inches by 48 inches, with 48 inches by 60 inches prescribed for freeways.

The sign should be erected on the left of the roadway within the median wherever there is a tendency for drivers to enter or cross and at random intervals as needed.



R11-1
24" x 30"

2B-37 Road Closed Sign (R11-2)

The ROAD CLOSED sign should be used to mark roads that have been closed to all traffic (except authorized vehicles) either because of construction or maintenance operations (Part VI) or because of a temporary emergency. It should not be used where traffic is maintained or where a route is detoured several miles in advance of the actual construction or blockade. In the latter case the Local Traffic Only sign (sec. 2B-38) should be used.

The Road Closed sign shall have a standard, and minimum, size of 48 by 30 inches.

Where the sign faces through traffic, it shall be preceded by an Advance Road Closed warning sign (sec. 6B-17) and, if applicable, an Advance Detour warning sign (sec. 6B-16).



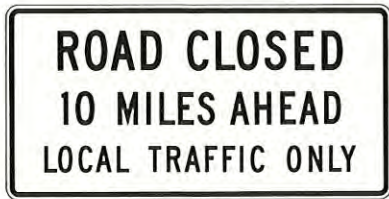
R11-2
48" x 30"

2B-38 Local Traffic Only Sign (R11-3, R11-4)

The Local Traffic Only sign should be used where through traffic must detour to avoid a closing of the highway for construction or maintenance work (Part VI), or for a temporary emergency some distance beyond, but where the highway is open for traffic up to the point of closure. It shall carry the legend ROAD CLOSED (10) MILES AHEAD—LOCAL TRAFFIC ONLY, or optionally for

urban application, ROAD CLOSED TO THRU TRAFFIC. Both signs shall be designed as horizontal rectangles.

The words BRIDGE OUT (or similar message) may be substituted for ROAD CLOSED where applicable. Where the sign faces through traffic, it shall be preceded by an Advance Road Closed warning sign (sec. 6B-17) with the secondary legend AHEAD and, if applicable, an Advance Detour warning sign (sec. 6B-16).



R11-3
60" x 30"



R11-4
60" x 30"

2B-39 Weight Limit Signs (R12-1 to 4)

Due to seasonal weakening of the road surface, obsolescence of bridges or pavements, or other impairment of roadway, it is often necessary to limit the load permitted on a roadway.

The Weight Limit sign (R12-1) carrying the legend WEIGHT LIMIT (10) TONS, may be used to indicate restrictions pertaining to total vehicle weight including load.

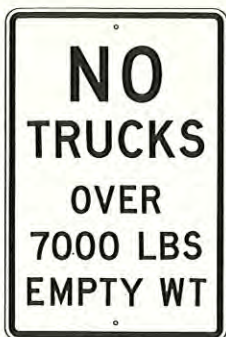
Where the restriction applies to axle weight rather than gross load the legend may be AXLE WEIGHT LIMIT (5) TONS (R12-2).



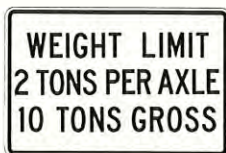
R12-1
24" x 30"



R12-2
24" x 30"



R12-3
24" x 36"



R12-4
36" x 24"

In residential districts, where it is intended to restrict trucks of certain sizes by reference to empty weight, the legend may read NO TRUCKS OVER (7000) LBS EMPTY WT (R12-3).

In areas where multiple regulations of the type described above are applicable, a sign combining the necessary messages on a single panel may be used, such as WEIGHT LIMIT (2) TONS PER AXLE 10 TONS GROSS (R12-4).

A Weight Limit sign shall be located immediately in advance of the section of highway or the structure to which it applies. The standard, and minimum, size shall be 24 inches by 30 inches but a larger size is desirable on major roads and streets.

2B-40 Weigh Station Signs (R13 Series)

The laws of many States provide for the establishment of Weigh Stations at ports of entry and elsewhere, and require that trucks and other classes of vehicles shall stop at these stations for weighing, inspection, and clearance. A regulatory sign is usually necessary to



R13-1
96" x 60"

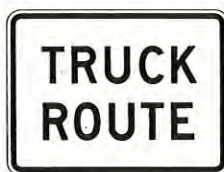
direct the concerned traffic into the Weigh Station. When so required, the message ALL TRUCKS/COMMERCIAL VEHICLES/NEXT RIGHT (R13-1) is recommended. This sign should be supplemented by a series of guide signs standardized for the identification and operation of Weigh Stations (sec. 2D-45).

Although the standard regulatory sign color combination is a black legend on a white background, the reverse color combination, white legend on black background, is preferred for this sign.

2B-41 Truck Route Sign (R14-1)

The TRUCK ROUTE sign (R14-1) should be used to mark an unnumbered truck route which has been designated by proper authority where either a weight limit restriction or a truck exclusion has been imposed on alternate routes.

On a numbered highway, the auxiliary TRUCK marker (sec. 2D-20) will be applicable.



R14-1
24" x 18"

2B-42 Railroad Crossbuck Sign (R15-1, 2)

The crossbuck shall be white with the words RAILROAD CROSSING in black lettering. If there are two or more tracks, including sidings, the number of tracks shall be indicated on an auxiliary sign of inverted T shape mounted below the crossbuck. The crossbuck shall be used at every railroad crossing, alone or in combination with other protective devices.

The design of the commonly used Railroad Crossbuck (R15-1) with auxiliary sign showing the number of tracks (R15-2), has been standardized by the Association of American Railroads.

The crossbuck sign is usually furnished and installed by the railroad company and is usually located on the railroad right-of-way. The distance that should be assumed to separate tracks before an additional crossing sign is considered necessary is 100 feet, unless local conditions require otherwise. The sign shall be erected on the right-hand side of the roadway on each approach to the crossing.

The practice, in some localities, of placing the Railroad Crossbuck sign on a pedestal or an island in the center of an undivided roadway is strongly disapproved. A Railroad Advance Warning sign (sec. 2C-31) should be used in advance of the Railroad Crossbuck.



R15-1
48" x 9"

(drilled for 90-degree mounting)



R15-2
9" x 9"
27" x 9"

2B-43 Other Regulatory Signs

Regulatory signs other than those classified and specified in this Manual may be required to aid the enforcement of other laws or regulations.

Typical miscellaneous regulatory signs are KEEP OFF WET PAINT, NO DUMPING ALLOWED, DO NOT THROW LITTER, NO FISHING FROM BRIDGE, and EMERGENCY AND AUTHORIZED VEHICLES ONLY, the uses of which are sufficiently obvious to require no detailed specifications. Care should be taken to avoid the use of special signs whenever a standard sign will serve the purpose.

C. WARNING SIGNS

2C-1 Application of Warning Signs

Warning signs are used when it is deemed necessary to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street. Warning signs require caution on the part of the motorist and may call for reduction of speed or a maneuver in the interest of his own safety and that of other motorists and pedestrians. Adequate warnings are of great assistance to the vehicle operator and are valuable in safe-guarding and expediting traffic. The use of warning signs should be kept to a minimum however, because the unnecessary use of them to warn of conditions which are apparent tends to breed disrespect for all signs.

Even on the most modern expressways there may be some conditions to which the driver can be alerted by means of warning signs. These conditions are in varying degrees common to all highways, and existing standards for warning signs are generally applicable to expressways.

Typical locations and hazards that may warrant the use of warning signs are:

1. Changes in horizontal alignment
2. Intersections
3. Advance warning of control devices
4. Converging traffic lanes
5. Narrow roadways
6. Changes in highway design
7. Grades
8. Roadway surface conditions
9. Railroad crossings
10. Entrances and crossings
11. Miscellaneous

The Advisory Speed plate (sec. 2C-36), used only to supplement one of the other standard warning signs, is in a special category as to design and application.

Special warning signs at highway construction and maintenance sites are dealt with in Part VI.

The determination of the sign or signs to be erected shall be on the basis of an engineering study using the following sections as guidelines.

Warning signs specified herein cover most conditions that are likely to be met. If other warnings are needed, the signs shall be of standard shape and color for warning signs, and the legends shall be brief and easily understood.

2C-2 Design of Warning Signs

All warning signs in this Part, with the following exceptions, shall be diamond-shaped (square with one diagonal vertical) with black legend and border on a yellow background.

Large Arrow Sign—horizontal rectangle with black symbol and border on yellow background.

Traffic Signal Ahead Sign—a red, yellow, green and black signal head symbol on a yellow diamond.

Railroad Advance Warning Sign—round with black legend on yellow background.

Advisory Speed plate—square with black legend on a yellow background.

No Passing Zone Sign—pennant shaped with black legend on yellow background.

Certain other exceptions are permitted if the message and location of the sign can justify the variance. This provision shall not be construed as permitting either a general use of rectangular warning signs or deviations from the standard messages where standard messages are applicable.

All warning signs having significance during the hours of darkness shall have a fully reflectorized background or be illuminated.

The standard size for each warning sign prescribed herein is shown with the illustration accompanying the specification. Where conditions of speed, volume, or special hazard require greater visibility or emphasis, larger signs should be used, with symbol or legend enlarged approximately in proportion to outside dimensions.

To carry proper emphasis among large signs for other purposes, all warning signs on expressways should be not less than 48 inches by 48 inches.

To permit the use of standard dies and templates the outside dimensions of warning signs should ordinarily be in multiples of 6 inches. Letter heights should be rounded to the nearest integral inch that will best fit the plate used for legibility and appearance.

2C-3 Placement of Warning Signs

Warning signs shall be erected in accordance with the general requirements for sign position (secs. 2A-21 to 29).

Since warning signs are primarily for the protection of the driver who is unacquainted with the road, it is very important that care be given to their locations. In rural areas, warning signs should normally be placed about 750 feet in advance of the hazard or conditions. On high-speed roads, and particularly on freeways, advance warning distances may have to be as great as 1,500 feet or more. Where speeds are relatively low in urban areas, the advance distance should be only about 250 feet.

The actual advance warning distance will be determined by two factors, the prevailing speed and the prevailing condition. These bear respectively on the time available to the driver to comprehend and react to the message, and the time needed by him to perform any necessary maneuver.

The effectiveness of the placement of any warning sign should be tested periodically under both day and night conditions.

Figure 2-5 shows typical installations of standard warning signs. The placement of temporary warning signs used at highway construction and maintenance sites is covered in Part VI of this Manual.

2C-4 Turn Sign (W1-1)

The Turn sign (W1-1R or 1L) is intended for use where engineering investigations of roadway, geometric, and operating conditions show the recommended speed on a turn to be 30 MPH or less,

and this recommended speed is equal to or less than the speed limit established by law or by regulation for that section of highway. Where a Turn sign is warranted, a Large Arrow sign (sec. 2C-9) may be used on the outside of the turn. Additional protection may be provided by use of the Advisory Speed plate (sec. 2C-36).



W1-1R
30" x 30"



W1-2R
30" x 30"

2C-5 Curve Sign (W1-2)

The Curve sign (W1-2R or 2L) is intended for use where engineering investigations of roadway, geometric, and operating conditions show the recommended speed on the curve to be in the range between 30 and 60 miles per hour and equal to or less than the speed limit established by law or by regulation for that section of highway. Additional protection may be provided by use of the Advisory Speed plate (sec. 2C-36).

2C-6 Reverse Turn Sign (W1-3)

The Reverse Turn sign is intended for use to mark two turns or a curve and a turn in opposite directions as defined in the warrants or Turn and Curve signs (secs. 2C-4 and 5) that are separated by a tangent of less than 600 feet. If the first turn is to the right, a Right Reverse Turn sign (W1-3R) shall be used and if the first turn is to the left, a Left Reverse Turn sign (W1-3L) shall be used.

For additional protection the Advisory Speed plate (sec. 2C-36) may be used.



W1-3R
30" x 30"



W1-4R
30" x 30"

2C-7 Reverse Curve Sign (W1-4)

The Reverse Curve sign is intended for use to mark two curves in opposite directions, as defined in the warrants for curve signs (sec. 2C-5) that are separated by a tangent of less than 600 feet. If the first curve is to the right, a Right Reverse Curve sign (W1-4R) shall be used, and if the first curve is to the left, a Left Reverse Curve sign (W1-4L) shall be used.

For additional protection the Advisory Speed plate (sec. 2C-36) may be used.

2C-8 Winding Road Sign (W1-5)

The Winding Road sign is intended for use where there is a series of turns or curves, as defined in the warrants for Turn and Curve signs (secs. 2C-4 and 5), separated by tangent distances of less than 600 feet. If the first turn or curve is to the right, a Right Winding Road sign (W1-5R) shall be used, and if the first curve or turn is to the left, a Left Winding Road sign (W1-5L) shall be used.

If the Winding Road sign is used it shall be erected in advance of the first curve.

Additional warning may be provided by the installation of road delineation markers (sec. 3D-4) and by use of the Advisory Speed plate (sec. 2C-36). Where there are fewer than five curves in succession, one or more Reverse Turn or Reverse Curve signs should be used in lieu of the Winding Road sign (W1-5).



W1-5R
30" x 30"

2C-9 Large Arrow Sign (W1-6, W1-7)

The Large Arrow sign shall be a horizontal rectangle with a standard size of 48 inches by 24 inches, having a large arrow (W1-6) or a double head arrow (W1-7). It shall have a yellow background with symbol in black for normal application.

A Large Arrow sign is intended to be used to give notice of a sharp change of alignment in the direction of travel. It cannot be justified where there is no change in the direction of travel (ends of medians, center piers, etc.).



W1-6
48" x 24"



W1-7
48" x 24"

The Large Arrow sign shall be erected on the outside of a curve or on the far side of an intersection, in line with, and at right angles to, approaching traffic.

To be effective the Large Arrow sign should be visible for at least 500 feet and trial runs by day and night may be desirable to determine final positioning.

2C-10 Cross Road Sign (W2-1)

The Cross Road sign is intended for use on a through highway to indicate the presence of an obscured crossroad intersection. It is not ordinarily used where Junction signs (secs. 2D-14, 2D-29) or other warning signs are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.

The diagram for a crossroad intersection with a slight offset should indicate that the side roads are not opposite each other. If the crossroad occurs in the vicinity of a curve the symbol may be modified appropriately.



W2-1
30" x 30"

2C-11 Side Road Sign (W2-2, W2-3)

The Side Road sign, showing a side-road symbol, either left or right, and at an angle of either 90 or 45 degrees, is intended for use in advance of a side-road intersection according to the same warrants as set forth for the Cross Road sign (sec. 2C-10).

The relative importance of the intersecting roads may be shown by different widths of line in the diagram. If the side road occurs in the vicinity of a curve the symbol may be modified appropriately.



W2-2
30" x 30"



W2-3
30" x 30"

2C-12 T Symbol Sign (W2-4)

The T symbol sign is intended for use to warn traffic approaching a T-intersection on the road that forms the stem of the T, i.e., where traffic must make a turn either to the right or to the left. The sign should not generally be used on an approach where traffic is required to stop before entering the intersection, nor at a T-intersection that is channelized by traffic islands, nor where Junction signs or Advance Turn Arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.



W2-4
30" x 30"



W2-5
30" x 30"

It may be desirable to place a double-headed Large Arrow sign at the head of the T, directly in line with approaching traffic (sec. 2C-9).

2C-13 Y Symbol Sign (W2-5)

The Y symbol sign is intended for use to warn traffic approaching a Y-intersection on the road that forms the stem of the Y. The sign should not generally be used at a Y-intersection that is channeled by traffic islands, nor where Junction signs or Advanced Turn Arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.

It may be desirable to erect a double-headed Large Arrow sign (sec. 2C-9) at the fork of the Y directly in line with approaching traffic.

2C-14 Stop Ahead Sign (W3-1)

A STOP AHEAD sign is intended for use upon approaching a STOP sign that is not visible for sufficient distance to permit the driver to bring his vehicle to a stop at the STOP sign. Obstruction(s) causing the limited visibility may be permanent or intermittent.

The STOP AHEAD sign shall be a minimum of 30 inches by 30 inches in size.

In some cases, it may be used for emphasis where there is poor observance of the STOP sign.



W3-1
36" x 36"



W3-2
36" x 36"

2C-15 Yield Ahead Sign (W3-2)

A YIELD AHEAD sign is intended for use upon approaching a YIELD sign that is not visible for sufficient distance to permit the

driver to bring his vehicle to a stop at the YIELD sign. Obstruction(s) causing the limited visibility may be permanent or intermittent.

The YIELD AHEAD sign shall be a minimum of 30 inches by 30 inches in size.

2C-16 Signal Ahead Sign (W3-3)

A Signal Ahead sign is intended for use in advance of any signalized location where physical conditions prevent drivers from having a continuous view of at least two signal indications for distances specified in section 4B-12. The word message SIGNAL AHEAD (W3-3a) may be used as an alternate.



W3-3
36" x 36"
24" x 18"



W3-3a
36" x 36"

2C-17 Merge Sign (W4-1)

A Merge sign is intended for use to warn motorists that merging movements may be encountered in advance of a point where two (2) roadways converge and no turning conflict occurs.

The sign should be erected on the side of the major roadway on which merging traffic will be encountered and in such a position as not to obstruct the driver's view of vehicles on the entering roadway. Ordinarily the motorists on the minor or ramp roadway are aware that they may have to merge with other traffic, but an additional sign may be placed on the entering roadway as a reminder. Where two roadways of approximately equal importance converge, a sign should be placed on each roadway.

The Merge sign should not be used in place of a Pavement Width Transition sign where lines of traffic moving on a single roadway

must merge due to a reduction in the actual or usable pavement width (sec. 2C-18).



W4-1
30" x 30"
24" x 18"

2C-18 Pavement Width Transition Signs (W4-2) (W9-1) (W9-2)

A Pavement Width Transition sign (W4-2) is intended for use if advance notice is needed to warn of the reduction in the number of lanes of pavement, as from three lanes to two lanes, or from four lanes to two lanes. It is not justified in advance of the end of an acceleration lane. It may be used through maintenance or construction sites (sec. 6B-22).

On one-way roadways where the width of the median island will permit, two such signs can be placed facing approaching traffic, one on the right side and the other on the median island.

The LANE ENDS MERGE LEFT (RIGHT) sign (W9-2) is intended for use as a supplement to the Pavement Width Transition sign (W4-2).

The RIGHT (LEFT) LANE ENDS sign (W9-1) is intended for use in advance of the Pavement Width Transition sign (W4-2) or the LANE ENDS MERGE LEFT (RIGHT) sign (W9-2) if it is used.



W4-2
36" x 36"



W9-1
30" x 30"



W9-2
36" x 36"

2C-19 Road Narrows Sign (W5-1)

A ROAD NARROWS sign is intended for use in advance of a transition on two-lane roads where the pavement width is reduced abruptly to a width such that two cars cannot pass safely without reducing speed. Additional protection may be provided by the use of reflector markers (sec. 3D-4).

2C-20 Narrow Bridge Sign (W5-2)

A NARROW BRIDGE sign is intended for use in advance of a bridge having a clear two-way roadway width of 16 to 18 feet, inclusive, or any bridge having a roadway clearance less than the width of the approach pavement. Additional protection may be provided by the use of reflector markers (sec. 3D-4).



W5-1
36" x 36"



W5-2
30" x 30"



W5-3
36" x 36"

2C-21 One Lane Bridge Sign (W5-3)

A ONE LANE BRIDGE sign is intended for use on two-way roadways in advance of bridges:

1. Having a clear roadway width of less than 16 feet
2. Having a clear roadway width of less than 18 feet when commercial vehicles constitute a high proportion of the traffic
3. When the alignment is poor on the approach to a structure having a clear roadway width of 18 feet or less.

Additional protection may be provided by the use of reflector markers (sec. 3D-4).

2C-22 Divided Highway (Road) Sign (W6-1)

A Divided Highway sign is intended for use on the approaches to a section of highway (not an intersection or junction) where the opposing flows of traffic are separated by a physical barrier. The word message DIVIDED HIGHWAY (ROAD) may be used as an alternate (W6-1a).



W6-1
36" x 36"
24" x 18"



W6-1a
36" x 36"

2C-23 Divided Highway (Road) Ends Sign (W6-2)

A Divided Highway (Road) Ends sign is intended for use at the end of a section of physically divided highway (not an intersection or junction) as a warning of two-way traffic ahead. The Two-way Traffic sign (sec. 2C-24) can be used to give additional warning and notice just in advance of the transition to the two-way section. The word message DIVIDED HIGHWAY (ROAD) ENDS may be used as an alternate (W6-2a).



W6-2
36" x 36"
24" x 18"



W6-2a
36" x 36"

2C-24 Two-Way Traffic Sign (W6-3)

A Two-Way Traffic sign is intended for use to give warning of a transition from a separated one-way roadway to a two-way roadway. This sign may be used as required at intervals to periodically remind

drivers that they are on a two-way roadway except in no-passing zones. The word message TWO WAY TRAFFIC (W6-3a) may be used as an alternate legend.



W6-3
30" x 30"
24" x 18"



W6-3a
30" x 30"

2C-25 Hill Sign (W7-1, W7-2)

The Hill sign (W7-1) is intended for use in advance of a down-grade where the length, percent of grade, horizontal curvature, or combination thereof, requires special precautions on the part of drivers. The word message HILL (W7-1a) may be used as an alternate legend.



W7-1
30" x 30"
24" x 18"



W7-1a
30" x 30"

Where conditions may require a descent of the grade in intermediate or low gear, the oversize Hill sign, 48 inches by 48 inches

in size, with a secondary message on a supplemental plate **USE SECOND GEAR (W7-2)**, **USE LOW GEAR (W7-2a)**, **TRUCKS USE LOWER GEAR (W7-2b)**, or similar warning, may be used.



W7-2
24" x 18"



W7-2a
24" x 18"



W7-2b
24" x 18"

2C-26 Bump Sign (W8-1)

A **BUMP** sign is intended for use to give warning of a sharp rise in the profile of the road that is sufficiently abrupt to create a hazardous condition, to cause considerable discomfort to passengers, to cause a shifting of the cargo, or to deflect a vehicle from its true course at the normal driving speeds for the road.

It may be desirable at some locations to supplement the **BUMP** sign with an **Advisory Speed** plate (sec. 2C-36).

2C-27 Dip Sign (W8-2)

A **DIP** sign is intended for use to give warning of a depression in the profile of the road that is sufficiently abrupt to create a hazardous condition to cause considerable discomfort to passengers, to cause a shifting of the cargo, or to deflect a vehicle from its true course at the normal driving speeds for the road.

It may be desirable at some locations to supplement the **DIP** sign with an **Advisory Speed** plate (sec. 2C-36).

The **DIP** sign shall not be used at a short stretch of depressed alignment that may momentarily hide a vehicle. Such a condition should be treated as a no-passing zone (secs. 3B-3 to 5).



W8-1
30" x 30"



W8-2
30" x 30"



W8-3
30" x 30"

2C-28 Pavement Ends Sign (W8-3)

A PAVEMENT ENDS sign is intended for use to warn where a pavement surface changes from a hard-surfaced pavement to a low-type surface or earth road.

2C-29 Soft Shoulder Sign (W8-4)

The SOFT SHOULDER sign is intended for use to warn of a shoulder condition that presents a hazard to vehicles that may get off the pavement.

One sign shall be placed near the beginning of the soft-shoulder condition, and other signs shall be placed at intervals throughout the length of the road where the condition exists.



W8-4
30" x 30"

2C-30 Slippery When Wet Sign (W8-5)

The Slippery When Wet sign is intended for use to warn of a condition where the highway surface is extraordinarily slippery when wet.

It should be located in advance of the beginning of the slippery section and at appropriate intervals on long sections of such pavement.



W8-5
30" x 30"
24" x 18"



W10-1
36" Diameter

2C-31 Railroad Advance Warning Sign (W10-1)

A Railroad Advance Warning sign shall be used in advance of every railroad crossing, except at a minor spur or siding which is infrequently used and which is guarded by train crews; or in the business districts of large cities where the crossings are fully protected; or where the physical conditions are such that even a partially effective display of the sign is impossible.

On a divided highway it may be desirable to erect a supplemental sign on the left shoulder of the roadway. In residence or business districts, where low speeds are prevalent, the sign may be placed a minimum distance of 100 feet from the crossing. If there is a street intersection within 100 feet an additional sign or signs may be placed to warn traffic approaching the crossing from each intersected street.

Railroad Advance Warning signs are usually off the railroad right-of-way and are properly the responsibility of the public authorities. The application of Railroad Crossbuck signs on the railroad right-of-way is described in section 2B-42.

2C-32 Bicycle Crossing Sign (W11-1)

The Bicycle Crossing sign is intended for use in advance of a point where an officially designated bicycle trail crosses a roadway.



W11-1
30" x 30"
24" x 18"

2C-33 Other Crossing Signs (W11 Series)

Other crossing symbol signs may be justified to warn of unexpected hazard or vehicular traffic. If the unexpected hazard or hazards are seasonal or temporary, the signs should be removed if and when the hazardous conditions are terminated or cease to exist.

In many instances it may be desirable to define the crossing by pavement markings (sec. 3B-15).



W11-2
30" x 30"
24" x 18"



W11-3
30" x 30"
24" x 18"



W11-4
30" x 30"
24" x 18"



W11-5
30" x 30"
24" x 18"

2C-34 Double Arrow Sign (W12-1)

The Double Arrow sign showing two arrows pointing downward to right and left is intended for use at loading and refuge islands, traffic islands with curbs and other obstructions in the roadway, where traffic is permitted to pass on either side of the island or obstruction. It shall have a standard, and minimum, size of 24 inches by 24 inches.

The sign should normally be mounted at a height of 7 feet from the pavement to the bottom of the sign. On an island, it should be mounted at the approach end or as close thereto as practicable. It

should be mounted on the face of, or just in front of a pier or other large obstruction, in which case stripe markings on the obstruction (sec. 3C-2) should be discontinued to leave a 3-inch space around the outside of the sign.

Where traffic must keep to the right of the island or other obstruction, the Keep Right regulatory sign (sec. 2B-24) should be used.



W12-1
24" x 24"

2C-35 Low Clearance Sign (W12-2)

The Low Clearance sign is intended for use to warn motorists of clearances less than the maximum vehicle height permitted plus 12 inches. It may be erected on or in advance of the structure. If a sign is placed on the structure, it may be a rectangular shape with the legend (12) FT (6) IN.

The actual clearance is normally shown on the sign to the nearest inch not exceeding the actual clearance. However, in areas that experience changes in temperature causing frost action, an allowance, not exceeding 3 inches, for this condition is recommended.



W12-2
36" x 36"
24" x 18"

Where the clearance is less than the legal limit, a sign to that effect should be placed at the nearest intersecting road or wide point in the road at which a vehicle can detour or turn around.

In the case of an arch or other structure under which the clearance varies greatly, two or more signs should be used as necessary on the structure itself, to give information as to the clearance over the entire roadway.

Clearances should be checked periodically, particularly in areas where resurfacing operations have taken place.

2C-36 Advisory Speed Plate (W13-1)

The advisory speed plate is intended for use to supplement warning signs. The standard size of the Advisory Speed plate shall be 18 inches x 18 inches. Advisory Speed plates used with 36 inch and larger warning signs shall be 24 inches x 24 inches.

The plate shall carry the message (35) MPH in black on a yellow background except for construction and maintenance signs (sec. 6B-34). The speed shown shall be a multiple of 5 miles per hour. The plate may be used in conjunction with any standard yellow warning sign to indicate the maximum recommended speed around a curve or through a hazardous location. It shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used, it shall be mounted on the same assembly with the standard warning sign, normally below it (fig. 2-1).

Except in emergencies, or at construction or maintenance sites, where the situation calling for an advisory speed is temporary, an Advisory Speed plate shall not be erected until the recommended speed has been determined by accepted traffic engineering procedures. Because changes in surface characteristics, sight distance, etc., may alter the recommended speed, each location should be periodically checked and the speed plate corrected if necessary.



W13-1
18" x 18"
24" x 24"

2C-37 Advisory Exit Speed Signs (W13-2, W13-3)

The Exit Speed or Ramp Speed signs are intended for use where engineering investigations of roadway, geometric or operating conditions show the necessity of advising drivers of the maximum recommended speed on a ramp.

Where additional advisory speed indication is needed on the ramp well beyond the gore, a standard warning sign with an Advisory Speed plate (W13-1) is to be used.



W13-2
48" x 60"



W13-3
48" x 60"

2C-38 Dead End Signs (W14-1, W14-2)

The DEAD END sign (W14-1) and NO OUTLET sign (W14-2) are intended for use to warn of a street or road which has no outlet and which terminates in a dead end or cul-de-sac. The sign shall be posted a sufficient advance distance to permit the vehicle operator to avoid the dead end by turning off, if possible, at the nearest intersecting street.



W14-1
30" x 30"



W14-2
30" x 30"

2C-39 No Passing Zone Sign (W14-3)

The NO PASSING ZONE sign may be used on a two-lane road to warn of the beginning of a no-passing zone identified by conventional pavement markings. When used it shall be erected on the left side of the roadway at the beginning of the no-passing zone and may supplement the DO NOT PASS sign (sec. 2B-20).



W14-3
36" x 48" x 48"

2C-40 Other Warning Signs

Warning signs other than those specified above may be required under special conditions. Special expressway design features may warrant the use of warning signs to meet unusual conditions. Warning signs should conform with the general specifications for shape, color, and placement of warning signs (sec. 2C-3).

The applications of such signs are sufficiently apparent as to require no detailed specifications.

Special warning signs for highway construction and maintenance sites are to be found in Part VI of this Manual.

D. GUIDE SIGNS—CONVENTIONAL ROADS**2D-1 Scope of Conventional Road Guide Sign Standards**

Specifications for Conventional Road Guide Signs prescribed herein shall apply to any road or street other than an expressway or freeway.

2D-2 Application

Guide signs are essential to guide the motorist along streets and highways, to inform him of intersecting routes, to direct him to

cities, towns, villages, or other important destinations, to identify nearby rivers and streams, parks, forests, and historical sites, and generally to give him such information as will help him along his way in the most simple, direct manner possible.

2D-3 Color, Reflectorization, and Illumination

Except where otherwise specified herein for individual signs or groups of signs or markers, Guide signs on conventional roads and streets shall have a white message on a green background, or as an alternate for this class of roads only, a black message on a white background. In either case, there should be consistency of application on any given highway.

Requirements for reflectorization or illumination are stated under the specific headings for individual guide signs or groups of signs. General provisions are given in sections 2A-16 through 2A-18.

2D-4 Size of Signs

For most guide signs the legend is so variable that there can be no rigidly standardized size. The sign size must be fixed primarily in terms of length of the message and the size of the lettering and spacing necessary for proper legibility. However, for signs with standardized designs, such as route markers, it is practicable to fix standard sizes.

Under some circumstances, particularly for overhead signs, the available space may limit sign width. A sign mounted over a particular roadway lane to which it applies may have to be limited in width to the width of the lane. Where vertical clearances are limited, and standard sign design cannot be used, a reduced letter height, interline and edge spacing may be used. When a reduction in the standard size is necessary, the design used should be as nearly comparable to standards as possible.

2D-5 Lettering Style

The standard lettering for conventional highway signs is upper-case letters (sec. 2A-15). However, when letter height exceeds 8 inches, place names on guide signs should be composed of lower-case letters with an initial upper-case letter. The initial upper-case letters shall be $1\frac{1}{3}$ times the "loop" height of the lower-case letters. Recommended designs have been developed for the upper-case and lower-case alphabets, together with tables of spacing.⁴

⁴ Available from the Federal Highway Administration, Washington, D.C. 20591.

2D-6 Size of Lettering

For guide signs with varying legend, sign legibility is a direct function of letter size. The legibility distance must give the driver sufficient time to read the sign before he has passed it. Although under the best conditions a guide-sign message can be read and understood in a brief glance, a reasonable safety factor must be allowed for inattention, blocking of view by other vehicles, unfavorable weather, inferior eyesight, or other causes for delayed or slow reading. On the other hand, the usual repetition of guide information on successive signs where conditions permit often gives a driver more than one opportunity to obtain the information he needs.

Though the reading time for any given sign varies greatly with the approach speed, standard lettering sizes should be consistent on any particular class of highways. The same conditions that induce lower speed—heavy traffic, frequent intersections or interchanges, unfavorable alignment, or extraneous distractions—usually create a need for greater legibility. Hence the size standards set forth are related to the type of highway rather than to variable speeds on any class of highways (Table II-1).

The minimum sizes specified should be exceeded where conditions indicate a need for greater legibility.

In rural districts on major routes, the principal legend on guide signs shall be in letters at least 6 inches in height. On less important rural roads and on urban streets the principal legend shall be in letters at least 4 inches high. Sign panels shall be large enough to accommodate the required legend without crowding.

Recommended layouts have been developed for standard highway signs showing interline, edge spacing and other specification detail.⁵

2D-7 Amount of Legend

Regardless of letter size, the legend on a guide sign must be kept to a minimum to be legible at a glance during the few moments that a driver can turn his eyes from the road. Guide signs should be limited to three lines of principal legend. Where two or more signs are included in the same overhead display, extra effort should be made to further reduce and simplify the amount of legend.

“Principal legend” here includes only place names, route numbers, and street names. Symbols, action information, cardinal directions

⁵ Ibid.

and exit numbers may make up other lines of legend, within reasonable limits.

2D-8 Arrows and Symbols

Arrows are used on many guide signs to indicate the directions toward designated routes or destinations. Arrows are pointed at any desired angle to convey a clear comprehension of the direction to be taken. At right-angle intersections a horizontal arrow is appropriate. On a roadside sign a directional arrow for a straight-through movement should point upward. For a turn the arrow should be pointed upward as will best describe the design of the intersection, and at an angle related to the sharpness of the turn.

On overhead signs where it is desired to indicate a lane to be followed, the arrow shall point downward toward the center of that lane. Where a roadway is leaving the through lanes, the arrows shall point upward at an angle representative of the alignment of the exit roadway. If required, the through roadway lanes will be identified by downward pointing arrows.

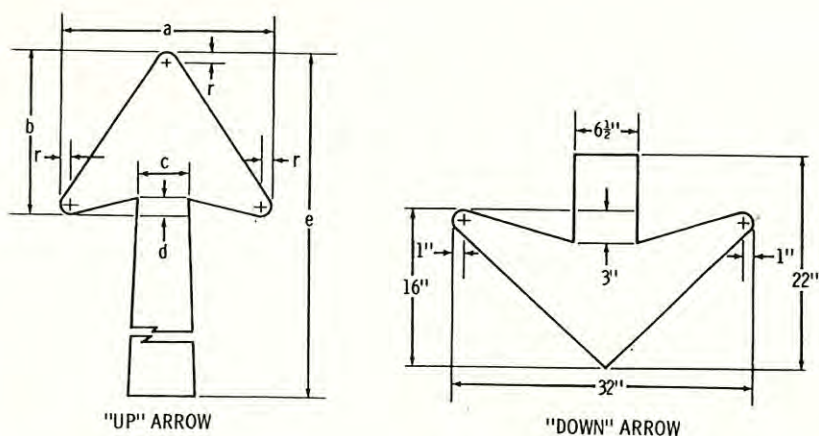
Downward pointing arrows shall be used only on overhead guide signs which restrict the use of specific lanes to traffic bound for the destination(s) and/or route(s) indicated by these arrows. Downward pointing arrows shall not be used unless an arrow can be pointed to each lane that can be used to reach the destination shown on the sign.

Arrows may be placed below the other sign legend, or to one side of it. At an exit, an arrow at the far side of the sign may help to emphasize the directional significance of the sign. For adequate legibility it is recommended that the width across the barbs of the arrow be at least equal to the height of the largest letters on the sign, and for short downward pointing arrows on overhead signs about $1\frac{3}{4}$ times the letter height (figure 2-7).

Diagrammatic signing using arrows should approximate the intersection roadway geometrics, or the necessary part of it, in a clear, understandable manner to impart a glance-legible message (secs. 2E-20, 2E-24). Therefore, the standard arrow designs and applications may not be applicable to this type of signing. Other symbol designs should be essentially as shown in this Manual.

2D-9 Numbered Highway Systems

The purpose of numbering and marking highway systems is to identify routes and facilitate travel over the shortest and best roads.



Dimensions of Arrow When Used With
Various Letter Sizes

LETTER SIZE (Upper-Case)	Arrow Dimensions in Inches					
	a	b	c	d	e*	r
8"	15-1/8	11-9/16	3-3/4	1-5/16	17-25	13/16
10"-13 1/3"	18-1/4	14	4-1/2	1-1/2	20-30	3/4
16"	22-1/4	17	5-3/8	1-3/4	25-35	1

* Taper of $\frac{1}{2}$ " per ft. should be held constant for longer or shorter shaft lengths.

Figure 2-7. Dimensions of arrows on guide signs.

The Interstate System and the United States (U.S.) System are numbered by the American Association of State Highway Officials, upon recommendation of the State highway departments. State and county systems are numbered by the appropriate authorities.

The basic guide for designating and numbering the U.S. System is the "Purpose and Policy in the Establishment and Development of United States Numbered Highways," published by the American Association of State Highway Officials.⁶

The principles of this policy should be followed in establishing other systems, with effective coordination between adjacent jurisdictions. Care should be taken to avoid the use of numbers or other designations which have been assigned to Interstate, U.S. or State routes in the same area. Overlapping numbered routes should be

⁶ Available from the American Association of State Highway Officials, 341 National Press Building, Washington, D.C. 20004.

avoided, and the systems shall be given preference, in this order: Interstate, United States, State and County.

2D-10 Route Markers and Auxiliary Markers

Route markers shall be used to identify and mark numbered highways, including Federal, State, or County roads, and park, forest and other public roads. The markers for each system of numbered highways, which are distinctive in shape and color, shall be used only on that respective system and the approaches thereto.

To accomplish their purpose route markers are usually mounted in assemblies which are formed when the route markers are accompanied by any of the various types of auxiliary markers.

Route markers as well as any auxiliary markers which accompany them shall be reflectorized for nighttime visibility as detailed in subsequent sections.

2D-11 Design of Route Markers (M1-1 to 7)

The design of route markers shall be established by the authority having jurisdiction. Specifications and provisions are as follows:

1. Interstate Route Markers for use on intersecting highways and roads approaching an interchange with an Interstate route shall consist of a cutout shield, with the route number and State name in white letters on a blue background, the word INTERSTATE in white letters on a red background, and white border. A 24-inch by 24-inch size is prescribed to accommodate route numbers with one or two digits, and a 30-inch by 24-inch size for route numbers having three digits or two digits and a suffix letter (sec. 2F-37).



Interstate
Route Marker

M1-1

24" x 24" (2-digit)

30" x 24" (3-digit)



Off-Interstate
Business Loop Marker

M1-2

24" x 24" (2-digit)

30" x 24" (3-digit)



Off-Interstate
Business Spur Marker

M1-3

24" x 24" (2-digit)

30" x 24" (3-digit)

2. Off-Interstate Business Route Markers shall consist of a cutout shield carrying the number of the connecting Interstate route and the words BUSINESS (LOOP or SPUR). The legend and border shall be white on a green background, and the shield shall be of the same shape and dimensions as the Interstate Route Marker previously described. In no instance is the word INTERSTATE to appear on the Off-Interstate Business Route Marker. This marker may be used on a major highway that is not a part of the Interstate System, but one that serves the business area of a city from interchanges on the System (sec. 2F-37).

3. U.S. Route Markers shall consist of a rectangular 24-inch by 24-inch or 30-inch by 24-inch plate, with black numerals on a white shield surrounded by a black background, without a border (fig. 2-8). This marker shall be used on all U.S. routes and in connection with route marker assemblies on intersecting highways.

4. State Route Markers are to be designed by the individual State highway departments. However, the States are encouraged to adopt a uniform State Route Marker. It is proposed that this Marker be a rectangular plate of approximately the same size as the U.S. Route Marker, with black numerals on a white area surrounded by a black background without a border. The shape of the white area is to be circular in the absence of any determination to the contrary by the individual States concerned.

5. Wherever County road authorities elect to establish and identify a special system of important County roads, County road identification markers are to be designed and used as specified in the publication "A Proposal for a Uniform County Route Marker Program on a National Scale."⁷ The Uniform County Route Marker shall be a pentagonal shape and shall consist of a reflectorized yellow legend (County name, route letter and number) and border on a blue back-



U.S.
Route Marker
M1-4
24" x 24" (2-digit)
30" x 24" (3-digit)



County
Route Marker
M1-5
24" x 24"

⁷ Available from the National Association of Counties, Washington, D.C. 20006.



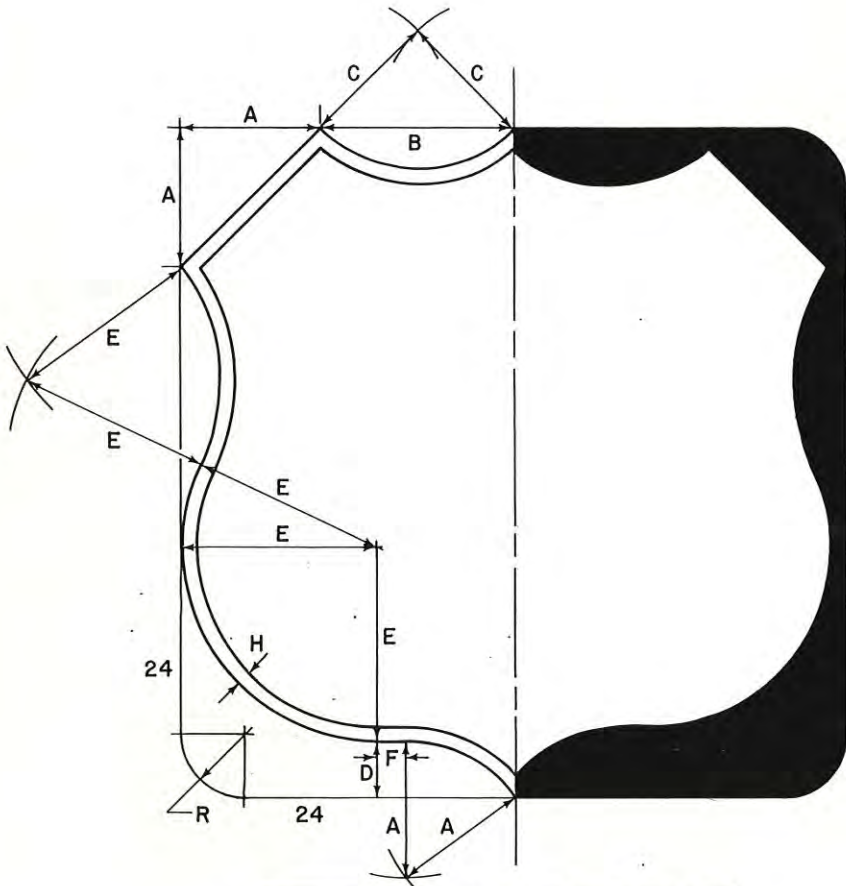
State Route Marker
M1-6

24" x 24" (2-digit) or 30" x 24" (3-digit)



Forest Route Marker
M1-7

24" x 24"



	A	B	C	D	E	F	H	R
24 X 24	5	7	5	2	7	1	1/2	1 1/2
30 X 24	5	10	9	2	7	4	1/2	1 1/2
36 X 36	7 1/2	10 1/2	7 1/2	3	10 1/2	1 1/2	3/4	2 1/4
45 X 36	7 1/2	15	13 1/2	3	10 1/2	5 1/2	3/4	2 1/4
48 X 48	10	14	10	4	14	2	1	3
60 X 48	10	20	18	4	14	8	1	3

Figure 2-8. U.S. route markers for use in assemblies or independently.

ground, of a size compatible with other route markers used in common assemblies.

6. Route markers for park and forest roads are to be designed with adequate distinctiveness and legibility and of a size compatible with other route markers used in common assemblies.

Route markers of any type may be proportionally enlarged to any required size where greater legibility is needed. Detailed drawings of U.S. Route Markers used independently or in assemblies are shown in figure 2-8. Where U.S. or State Route Markers are used as components of guide signs, only the outline of the shield or other distinctive shape should be used as shown in the illustration of the Combination Junction sign (sec. 2D-14).

Route markers may be either fully reflectorized or only in the numerals and, where applicable, the border. However, where they are a part of a reflectorized background sign, they shall be fully reflectorized if color design permits.

2D-12 Design of Route Marker Auxiliaries

Route marker auxiliaries carrying word legends, except the JCT marker, should have a standard size of 24 inches by 12 inches. Those carrying arrow symbols, or the JCT marker, should have a standard size of 21 inches by 15 inches. Auxiliary markers carrying word messages and mounted with 30-inch by 24-inch Interstate Route Markers should be 30 inches by 15 inches. With route markers of larger sizes, the auxiliary markers should be suitably enlarged, but should not exceed the width of the route marker itself.

Route marker auxiliaries shall have black legend on a reflectorized white background, except for the following:

1. Where posted with Interstate Route Markers, the auxiliaries shall have reflectorized white legend on reflectorized blue background.
2. Where posted with Off-Interstate Business Route Markers, the auxiliaries shall have reflectorized white legend on reflectorized green background.

Detour markers have a distinctive design as described in section 2D-24.

If desired, a route marker and any auxiliaries used with it may be combined on a single panel of approximately the same overall dimensions as the assembly.

2D-13 Junction Marker (M2-1)

The Junction marker shall carry the abbreviated legend JCT and is intended to be mounted at the top of an assembly (sec. 2D-29), either directly above the route marker or above a marker for an

alternative route (sec. 2D-17) which is part of the route designation. The minimum size of the Junction marker shall be 21 inches by 15 inches for compatibility with auxiliary markers carrying arrow symbols.



M2-1
21" x 15"

2D-14 Combination Junction Sign (M2-2)

As an alternative to the standard Junction assembly where more than one route is to be intersected or joined, a rectangular sign may be used carrying the word JUNCTION above the route numbers. The sign will normally have a black or green background with reflectorized white border and lettering for the word JUNCTION, reflectorized white route marker shields, and black for the route designations. Other designs may be used to accommodate State and County Route Markers. The size of the sign will depend on the number of routes involved, and the numerals should be large enough for clear legibility, comparable with those in the individual route markers.



M2-2
Variable Size

2D-15 Cardinal Direction Marker (M3-1 to M3-4)

The Cardinal Direction marker carrying the legend EAST, WEST, NORTH or SOUTH is intended to be mounted directly

above a route marker to indicate the general direction of the entire route.



M3-1
24" x 12"



M3-2
24" x 12"



M3-3
24" x 12"



M3-4
24" x 12"

2D-16 Markers for Alternative Routes

Markers indicating an alternative routing for a special purpose, carrying the legend **ALTERNATE**, **BYPASS**, **BUSINESS** or **TRUCK** are intended to be mounted directly above a route marker for use on a route designated as an alternate to a route of the same number between two points on that route.

2D-17 Alternate Marker (M4-1, M4-1a)

The **ALTERNATE** (or **ALT**) marker is intended to be used to indicate an officially designated alternate routing of a numbered route between two points on that route. The shorter or better constructed route should be given the regular number.



M4-1
24" x 12"



M4-1a
24" x 12"



M4-2
24" x 12"



M4-3
24" x 12"

2D-18 Bypass Marker (M4-2)

The BYPASS marker is intended to be used to designate a route that branches from the regular numbered route through a city, bypasses a part of the city or congested area, and rejoins the regular numbered route beyond the city.

2D-19 Business Route Marker (M4-3)

The BUSINESS route marker is intended to be used to designate an alternate route that branches from a regular numbered route, passes through the business portion of a city and rejoins the regularly numbered route beyond that area.

2D-20 Truck Route Marker (M4-4)

The TRUCK marker is intended to be used to designate an alternate route that branches from a regular numbered route, bypasses an area which is congested or where height or weight limitations have been established, and rejoins the regularly numbered route beyond that area.

2D-21 To Marker (M4-5)

The TO marker is intended to be used to provide directional guidance to a particular road facility (sec. 2D-34) from other highways in the vicinity and is to be mounted directly above a route marker.



M4-4
24" x 12"



M4-5
24" x 12"



M4-6
24" x 12"



M4-7
24" x 12"

2D-22 End Marker (M4-6)

The END marker is intended for use where the route being traveled ends at a junction with another route. This marker is to be

mounted either directly above a route marker, or above a marker for an alternative route (sec. 2D-16) which is part of the designation of the route being terminated.

2D-23 Temporary Marker (M4-7)

The TEMPORARY marker is intended to be used to mark for an interim period a section of highway connecting completed portions of a route that is not planned as a permanent part of a regular numbered route. This marker is to be mounted either directly above the route marker or above a Cardinal Direction marker or a marker for an alternative route which is part of the route designation.

Where it is planned to relocate a route at a later date, use of the "Temporary" designation will often help to avoid future misunderstanding and ill feeling.

Temporary markers shall be promptly removed when the temporary route is abandoned.

2D-24 Detour Marker (M4-8)

The DETOUR marker is intended to be used to mark a temporary route that branches from a regular numbered route, bypasses a section of a route which is closed or blocked by construction, major maintenance, roadway damage or traffic emergency and rejoins the regularly numbered route beyond that section.

The DETOUR marker shall have a black legend on a reflectorized orange background. It is to be mounted at the top of a route marker assembly.



M4-8
24" x 12"



M4-9R
30" x 24"

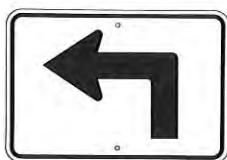
2D-25 Detour Sign (M4-9R and 9L)

An alternative method for marking detours, particularly in emergencies, is the use of the DETOUR sign (M4-9). This is a rectangular sign having a black message and border on a reflectorized orange background.

This sign is to be used where a route number does not exist; or where, over relatively short distances, it is not necessary to show route numbers to guide traffic along the detour and back to its desired route. It is intended for use in emergency situations and for periods of short duration. The Detour Arrow sign (sec. 6B-38) is prescribed for use on barricades in the roadway where a road is closed for construction or for major maintenance operations.

2D-26 Advance Turn Arrow (M5-1, M5-2)

The Advance Turn Arrow marker displays a right or left arrow, the shaft of which is bent at a right angle or at a 45° angle. It is intended to be mounted below the route marker in advance turn assemblies.



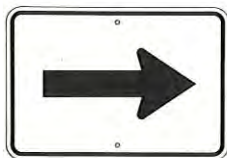
M5-1
21" x 15"



M5-2
21" x 15"

2D-27 Directional Arrow (M6-1 to M6-7)

The Directional Arrow marker displays a single- or double-headed arrow pointing in the general direction that a route may be followed. It is intended to be mounted below the route marker in directional assemblies.



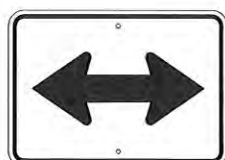
M6-1
21" x 15"



M6-2
21" x 15"



M6-3
21" x 15"



M6-4
21" x 15"



M6-5
21" x 15"



M6-6
21" x 15"



M6-7
21" x 15"

2D-28 Route Marker Assemblies

A Route Marker assembly consists of a route marker and auxiliary markers which further identify the route and indicate direction. Assemblies for two or more routes, or for different directions on the same route, are mounted in groups on a common support.

Route Marker assemblies shall be erected on all approaches to the intersection of numbered routes, and may be erected on the approaches to numbered routes on unnumbered roads and streets which carry an appreciable amount of traffic destined for the numbered route.

Where two or more routes follow the same section of highway, the Route Markers for Interstate, U.S., or State and County routes shall be mounted in that order from the left in horizontal arrangements and from the top in vertical arrangements. Subject to this order of precedence, Route Markers for lower-numbered routes shall be placed at the left or top.

Within groups of assemblies, information for routes intersecting from the left shall be mounted at the left in horizontal arrangements and at the center of vertical arrangements. Similarly, information for routes intersecting from the right shall be at the right or bottom, and for straight-through routes at the center or top.

Route Marker assemblies shall be mounted in accordance with the general specifications for highway signs, with the lowest unit in the assembly at the height prescribed for single signs.

The design and location of route marker assemblies as indicated, is made mandatory by the word "shall" in the descriptive para-

graphs. However, it should be recognized that groups of assemblies which include overlapping routes and multiple turns may be confusing. Where studies indicate this possibility exists, omission or combination of either route markers or auxiliary markers is permitted, provided that clear directions are given to motorists.

2D-29 Junction Assembly

A Junction assembly shall consist of a Junction marker and a Route Marker, plus an alternative route marker, if applicable.

The Junction assembly shall be erected in advance of every intersection where a marked route is intersected or joined by another marked route. The Route Marker shall carry the number of the intersected or joined route. Where two or more routes are to be indicated, one Junction marker shall be used for the assembly and all Route Markers grouped in a single mounting, or a Combination Junction sign (sec. 2D-14) may be used.

In urban districts, the Junction assembly shall be erected approximately midway in the block preceding the intersection, but generally not more than 300 feet in advance of the intersection.

In rural districts, the Junction assembly shall be erected not less than 400 feet in advance of the intersection, on the right-hand side of the road. In such areas, the minimum distance between the Destination sign, the Route Turn assembly, and the Junction assembly shall be 200 feet. Where prevailing speeds are above 45 m.p.h., greater spacings are desirable.

2D-30 Advance Route Turn Assembly

An Advance Route Turn assembly shall consist of a Route Marker and an Advance Turn Arrow marker, plus an alternative route marker if applicable, and a Cardinal Direction marker if needed.

The Advance Route Turn assembly shall be erected in advance of a turn which must be made to follow the indicated route.

In rural districts, the Route Turn assembly shall be erected not less than 400 feet in advance of the turn. In urban areas, the Route Turn assembly should be erected 300 feet in advance of the turn. The assembly should never be placed where there is an intersection between it and the designated turn.

2D-31 Directional Assembly

A Directional assembly shall consist of a Route Marker and a Directional Arrow, plus an alternative route marker if applicable, and a Cardinal Direction marker if needed.

The various uses of Directional assemblies are outlined below:

1. Straight-through movements should be indicated by a Directional assembly with a Route Marker displaying the number of the

continuing route, and a vertical arrow. A Directional assembly should not be used for a straight-through movement in the absence of other assemblies indicating right or left turns, as the Confirming marker beyond the intersection normally provides adequate guidance.

2. Turn movements (indicated in advance by a Route Turn assembly) shall be marked by a Directional assembly with a Route Marker displaying the number of the turning route and a single-headed arrow pointed in the direction of the turn.

3. The beginning of a route (indicated in advance by a Junction assembly) shall be marked by a Directional assembly with a Route Marker displaying the number of that route and a single-headed arrow pointed in the direction of the turn.

4. The end of a route shall be marked by a Directional assembly with an END marker and a Route Marker displaying the number of that route.

5. An intersected route (indicated in advance by a Junction assembly) shall be marked by:

a. A Directional assembly with a Route Marker displaying the number of the intersected route and a double-headed arrow, pointing at appropriate angles to the left, right or ahead, or

b. Two Directional assemblies, each with a Route Marker displaying the number of the intersected route, Cardinal Direction markers and single-headed arrows pointed in the directions of movement on that route.

Directional assemblies should be located on the near right-hand corner of the intersection. At major intersections and at Y or offset intersections it is often desirable to install additional assemblies on the far right-hand or left-hand corner to confirm the near-side assemblies.

It is more important that guide signs be readable at the right time and place than that they be located with absolute uniformity. When the near-corner position is not practical for Directional assemblies, the far right-hand corner is the preferred alternative, with oversize signs if necessary for legibility. Similarly, if it is found advantageous to place a Directional assembly where it can be read at close range without interference from cross traffic, the most suitable location should be determined by engineering judgment.

2D-32 Confirming Assembly

A Confirming assembly shall consist of a Cardinal Direction marker and a Route Marker, plus an alternative Route Marker if applicable.

The Confirming assembly shall be erected just beyond intersections of numbered routes where there may be some doubt as to the proper choice of route.

In rural districts, the Confirming assembly should be placed not less than 25 feet nor more than 200 feet beyond the far shoulder or curb line of the intersected highway. In urban districts these distances should be 10 feet and 100 feet respectively.

2D-33 Confirming Assembly Used as a Reassurance Marker

As a Reassurance marker, a Confirming assembly shall consist of a Route Marker, plus an alternative Route Marker if applicable, and should include a Cardinal Direction marker.

Reassurance markers should be erected between intersections in urban districts as required and beyond the built-up area of any incorporated city or town.

Route markers for either confirming or reassurance purposes should be spaced at such intervals as necessary to keep the driver informed of his route. In congested urban areas, the proper location of route markers is extremely important because it is very easy for the traveler to become confused and lose his route. Extreme care should be taken to erect the markers where they can be seen easily. If necessary, they should be located on the far-side of every intersection along a numbered route, or so that at all times a route marker is visible ahead.

2D-34 Trailblazers

Some traffic authorities have found it desirable to provide directional guidance to a particular road facility from other highways in the vicinity. This is accomplished by means of "Trailblazers" erected at strategic locations, usually along major urban arterials, to indicate the direction to the nearest or most convenient point of access. The use of the word TO indicates that the road or street where the marker is posted is not a part of the indicated route, and that a driver is merely being directed progressively to the route.

A Trailblazer assembly shall consist of a TO marker, a Cardinal Direction marker if needed, a Route Marker or a special road facility symbol, and a single-headed Directional Arrow pointed along the route leading to the facility. The Route Marker or symbol should not exceed 24 inches by 24 inches unless a 3-digit route numeral or equivalent designation must be accommodated, in which case the appropriate enlarged size may be used. The TO marker, Cardinal Direction marker, and Directional Arrow should be of the size specified for auxiliary markers of their respective type.

Trailblazer assemblies may be erected in groups with other route marker assemblies, or alone, in the immediate vicinity of designated facilities, but their use should not be extended for long distances.



Trailblazer
Assembly

2D-35 Destination and Mileage Signs

In addition to guidance by route numbers it is necessary to supply the traveler information concerning the destinations that can be reached by way of numbered or unnumbered routes. This is done by means of Destination and Mileage signs.

These signs shall have a reflectorized white legend and border on a green background, or as an alternate on conventional roads only, a black legend and border on a reflectorized white background. Reflectorization of the green background is optional. On any particular highway, reflectorization should be consistently uniform.

Destination names should be in lower-case letters with initial upper-case when letter height exceeds 8 inches.

2D-36 Destination Signs (D1-1 to 3)

Except where special interchange signing is prescribed, the Destination sign shall be a horizontal rectangle carrying the name of a city, town, village, or other objective, and a directional arrow. The mileage to the place named may also be shown. If several destinations are to be shown at a single point, the several names may be placed on a single panel with an arrow (and the mileage, if desired) for each name. If more than one destination lies in the same direc-

tion, a single arrow may be used for such a group of destinations, but in any case adequate separation should be made between any destinations or group of destinations in one direction and those in other directions, by suitable design of the arrows, spacing of lines of legend, heavy lines entirely across the panel, or separate panels.

An arrow pointing to the right shall be at the extreme right of the sign, and an arrow pointing left or vertically shall be at the extreme left for signs mounted on the right side of the roadway. The mileage figures, if used, shall follow after the destination name. As a general rule, the directional arrows should be horizontal or vertical, but at an irregular intersection a sloping arrow will sometimes convey a clearer indication of the direction to be followed.

The size of the lettering for U.S. and State numbered routes and other major routes shall be no less than that specified in section 2D-6. If several individual name panels are assembled into a group, all panels in the assembly should be of the same length.



D1-1
Variable Size



D1-2
Variable Size



D1-3
Variable Size



D1-1a
Variable Size



D1-2a
Variable Size



D1-3a
Variable Size

Destination signs are generally warranted:

1. At the intersections of U.S. or State numbered routes with Interstate, U.S. or State numbered routes.
2. At points where they serve to direct traffic from U.S. or State numbered routes to the business section of towns, or to other destinations reached by unnumbered routes.

Not more than three names shall be used on a destination sign. The next most important destination lying straight ahead should

be at the top of the sign or assembly, and below it the next important destinations to the left and to the right, in that order. In the case of overlapping routes, there should be shown only one destination in each direction for each route. If there is more than one destination shown in any direction, the name of the nearest city or town shall appear above that of any farther away. The destination shown for each direction should ordinarily be the next county seat or the next principal city, rather than a more distant destination.

2D-37 Location of Destination Signs

In rural districts, Destination signs should be located not less than 200 feet in advance of the intersection, and following any Junction or Route Turn assemblies that may be required. In urban districts shorter distances may be justified. The Destination sign is of lesser importance than the Junction, Turn or Directional assemblies; therefore, when sign spacing is critical the Destination sign can be eliminated.

Height and lateral placement of Destination signs shall be in accordance with the general standards for sign erection.

Figures 2-6a, b and c show the use of Destination signs at rural intersections.

2D-38 Mileage Sign (D2-1 to 3)

The Mileage sign shall be a horizontal rectangle of a size appropriate to the required legend, carrying the names of not more than three cities, towns, or villages, and the mileages (to the nearest mile) to those places.

The top name should be that of the next place on the route having a post office, railroad station, route number or name of an intersected highway, or other significant geographical identity. The lowermost name should be that of the major destination or "control city." If three destinations are shown, the middle line should be used to indicate communities of general interest along the route, or important route junctions. The choice of names for this middle line can be varied on successive mileage signs to give motorists maximum information concerning communities served by the route..

The "control city" should remain the same on successive signs throughout the length of the route until that destination is reached. There are circumstances, however, under which more than one distant point may properly be designated, as for example, where the route divides at some distance ahead to serve two destinations of similar importance. If these two destinations cannot appear on the same sign, some alteration of the two names may be justified. On a route continuing into another State, the name of a city in the adjacent State may be shown.



D2-1
Variable Size



D2-2
Variable Size



D2-3
Variable Size

2D-39 Location of Mileage Signs

Mileage signs should be erected on important routes leaving municipalities, and just beyond intersections of numbered routes in rural areas.

Mileage signs shall be placed on the right-hand side of the road facing traffic leaving the municipality, approximately 500 feet outside of the municipal limits, or at the edge of the built-up district if it extends beyond the corporation limits. Where overlapping routes separate a short distance from the corporation limits, the Mileage sign at the corporation limits should be omitted, and instead should be erected 300 feet beyond the junction of the two routes.

Where, just outside of an incorporated municipality, two routes are concurrent and continue concurrent to the next incorporated municipality, the top name on the sign placed at such a point should be that of the place where the routes separate; the lower name should be that of the city in which the greater part of the through traffic is interested.

Mileage signs shall be erected in accordance with the general standards for sign erection.

Figures 2-6a, b and c show the use of Mileage signs at rural intersections.

2D-40 Street Name Sign (D3)

Street Name signs should be erected in urban areas at all street intersections regardless of other route marking that may be present and should be erected in rural districts to identify important roads not otherwise marked.

Lettering on street name signs should be at least 4 inches high. Supplementary lettering to indicate the type of street (e.g., Street, Avenue, Road, etc.) or section of city (e.g., N.W.) may be in smaller lettering, at least 2 inches high. Conventional abbreviations are acceptable except for the street name itself.

The Street Name sign should be reflectorized or illuminated. The legend and background shall be of contrasting colors and should have a white message and border on a green background.

In business districts and on principal arterials, Street Name signs should be placed at least on diagonally opposite corners so that they will be on the far right-hand side of the intersection for traffic on the major street. Signs naming both streets should be erected at each location. They should be mounted with their faces parallel to the streets they name.

In residential districts at least one Street Name sign should be mounted at each intersection.

A supplemental advance street name sign may be erected on more important intersection approaches or below an intersection warning sign. When combined with a yellow diamond sign, the color should be a black message on a yellow background.



D3
Variable Size



D4
30" x 24"

2D-41 Parking Area Sign (D4)

The Parking Area sign may be used where it is desired to show the direction to a nearby public parking area. The sign shall be a horizontal rectangle of a standard size of 30 inches by 24 inches with a smaller size of 18 inches by 15 inches for secondary, low-speed streets. It shall carry the word PARKING, with the letter P five times the height of the remaining letters, and a directional arrow. The legend and border shall be green on a reflectorized white background.

If used, the Parking Area sign should be erected on major thoroughfares at the nearest point of access to the parking facility and where it can help relieve the local streets of traffic seeking a place to park. In general, the sign should not be used more than three or four blocks from the parking area. It shall be mounted in accordance with the general specifications for the erection of signs (secs. 2A-23, 24).

2D-42 Rest Area Signs (D5-1 to 5)

It is common practice on rural highways to provide roadside parks or rest areas where a traveler may stop safely away from passing traffic. It is desirable to erect word messages or symbols in advance of such areas to permit the driver to reduce speed and leave the highway safely if he desires to stop. Messages such as REST AREA (1) MILE (D5-1), PARKING AREA (1) MILE (D5-3), or ROADSIDE TABLE (D5-5) are typical. Other messages such as ROADSIDE PARK 1000 FEET, PICNIC TABLE $\frac{1}{4}$ MILE, or PARKING AREA $\frac{1}{2}$ MILE are also appropriate. Signs for this purpose shall have reflectorized white letters, symbols and border on a blue background.

**D5-1****D5-2****D5-3****D5-4****D5-5**
D5-5a
 24" x 24"
 24" x 6"
2D-43 Scenic Area Signs (D6-1 to 3)

Scenic areas may be marked by signs carrying the message SCENIC AREA, SCENIC VIEW or the equivalent together with appropriate directional information. The design of the signs should be consistent with that specified for rest areas and should have reflectorized white letters, symbols, and border on a blue background. An advance sign and an additional sign at the turnoff point are usually required for this kind of attraction.



D6-1



D6-2



D6-3

2D-44 Recreation Area Signs (D7-1, 2)

Where public parks and recreation areas are a significant destination on a numbered highway route, special signs may be posted for such parks and areas, at least to the first point at which an access road intersects the highway. In lieu of the regular Guide sign shape and color, such signs may have a trapezoidal shape and shall have reflectorized white letters, symbols, and border on a brown background.



D7-1
Variable Size



D7-2
Variable Size

2D-45 Weigh Station Signing (D8-1 to 3)

The general concept for Weigh Station signing is similar to Rest Area signing, since in both cases traffic using either area remains within the right-of-way.

The standard installation for Weigh Stations shall include three basic signs:

1. Advance sign (D8-1)
2. Exit Direction sign (D8-2)—optional
3. Exit Point sign (D8-3)

The location, design, color, and letter size is shown in figure 2-9.

Where State law requires a regulatory sign in advance of the Weigh Station, a fourth sign (sec. 2B-40) may be located following the Advance sign. If used, the Exit Direction sign shall be limited to three lines of message in addition to NEXT RIGHT or RIGHT LANE at the bottom. The supplemental panel on the Exit Direction sign or Advance sign should be a changeable message displaying either OPEN or CLOSED. Design of this panel for remote control of the changeable message is recommended, but provision may be made for changing the message manually.

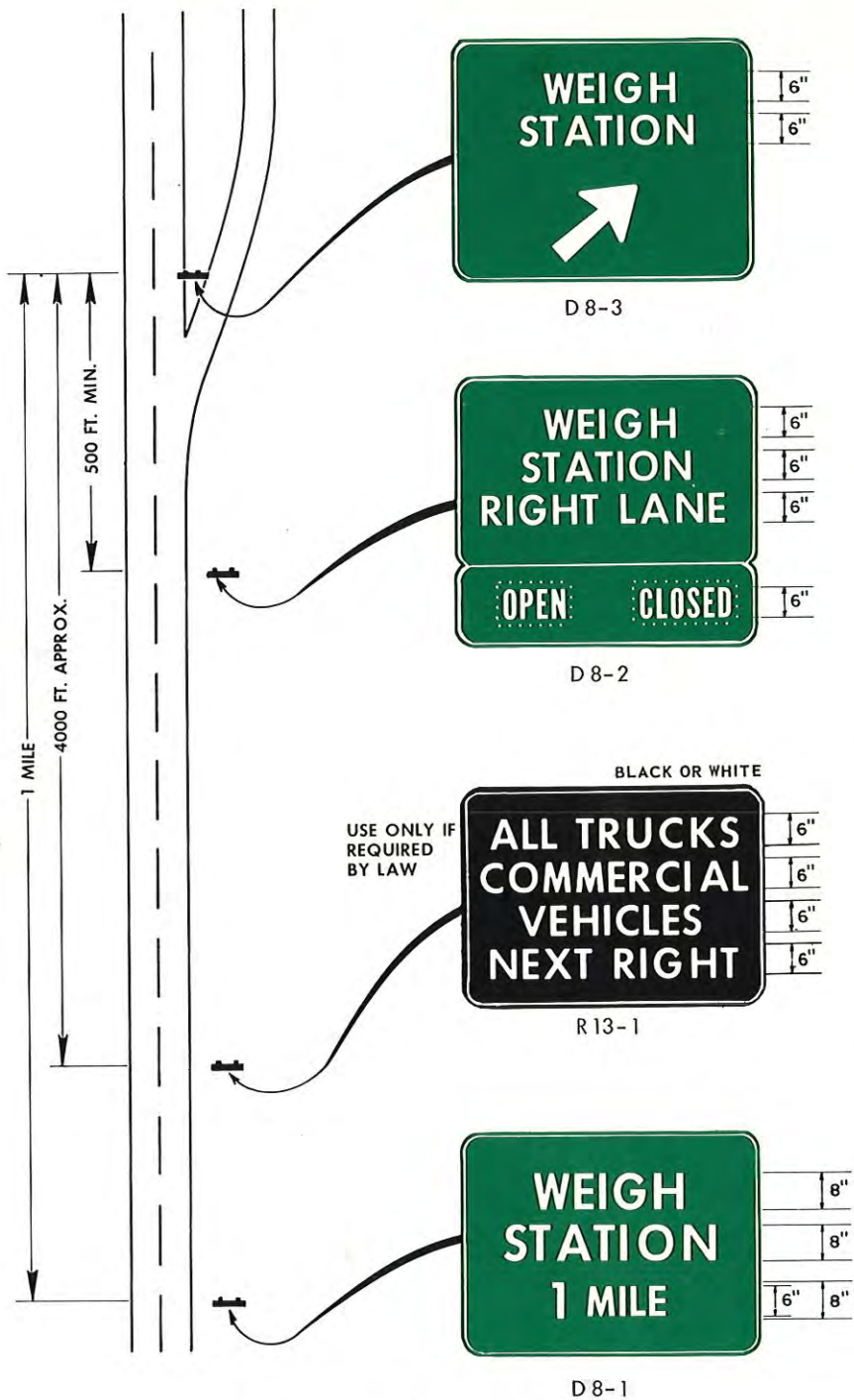


Figure 2-9. Weigh station signing.

2D-46 Service Signs (D9-1 to 3)

On conventional highways commercial services such as gas, food and lodging are generally within sight and available to the traveler at reasonably frequent intervals along the route. Consequently, there is not expected to be much need on this class of roads for special signs calling attention to these services. Moreover, it is assumed that service signing will not be required in urban areas.

It is quite likely, however, that general motorist service signs will be desirable or necessary where such services are infrequent, and are to be found only on an intersecting highway or crossroad. Under such conditions, States that elect to provide service signing should establish a statewide policy or warrant for its use and criteria for the availability of services, based on national guidelines. Local jurisdictions responsible for such signing should follow the State policy for the sake of uniformity.

General motorist service signs, if used, shall carry word legends for one or more of the following services: FOOD, GAS, LODGING, CAMPING, PHONE, HOSPITAL, along with a directional legend NEXT RIGHT, SECOND RIGHT, or the like. Individual symbol-type signs may be used for separate facilities (D9-1 to D9-3). The signs shall have reflectorized white letters, symbols and border on a reflectorized or opaque blue background and are to be erected at a suitable distance in advance of the turnoff point or intersecting highway.

Although word messages for service signs are standard for the United States, research and experimentation is encouraged to develop adequate symbols which can be incorporated in subsequent revisions.



D9-1
24" x 30"



D9-2
24" x 24"
24" x 6"



D9-3
24" x 24"
24" x 6"



D9-3
24" x 24"
24" x 6"

Where the distance to the next point at which services are available is 10 miles or more, a sign NEXT SERVICES (12) MILES may be used as a separate panel mounted under the general motorist services sign.

2D-47 Mileposts (D10-1 to 3)

To assist the driver in estimating his progress, to provide a means for identifying the location of emergency incidents, and to aid in highway maintenance and servicing, Mileposts may be erected along any section of a numbered highway route. Zero mileage should begin at the south and west state lines and at junctions where routes begin.

The mileage numbering shall be continuous for each route within a State, except where overlaps occur. With overlapped routes, continuity shall be established for only one of the routes. On the route without milepost continuity, the first milepost beyond the overlap should indicate the total distance traveled on the route so that a motorist may have a means of correlating his travel distance between mileposts with that shown on his odometer.

Milepost signs shall be vertical panels with 6-inch white numerals, a border and the word MILE in 4-inch letters on a green background and shall be reflectorized. Milepost signs shall be mounted at a minimum height and lateral placement equal to that used for delineators.

For divided highways, mileage measurement shall be made on northbound and eastbound roadways. The mileposts for southbound and westbound roadways shall be set at locations directly opposite. When a milepost cannot be erected in its correct location, it may be moved in either direction as much as 50 feet. If it cannot be placed within 50 feet of its correct location, it should be omitted.

While milepost signs serve as a guide sign for motorists, they also provide a means of identifying traffic accident locations and sections of highway for maintenance or other purposes. To further enhance the usefulness of the mileposting, delineators may be spaced at 528 feet ($\frac{1}{10}$ mile) or 264 feet ($\frac{1}{20}$ mile) and can be marked in fractions of a mile by stencil on the back of the delineator or post or by a small plate on the delineator post. This plate shall not be considered as a milepost, therefore will not be green and white in color. The numerical size shall be small and preferably on the back side of the post or delineator.



D10-1
10" x 18"



D10-2
10" x 27"



D10-3
10" x 36"

2D-48 Bicycle Route (D11-1)

A guide for marking an officially designated bicycle trail shall be a 24 inch by 18 inch sign with a white legend consisting of a bicycle symbol, the word BIKE ROUTE, and a border in white on a green



D11-1
24" x 18"
24" x 6"



11-1
12" x 18"

background. This sign is intended to guide cyclists on a predetermined bicycle route that may be a trail, secondary road, or a combination of safe and suitable surfaces.

When needed, a supplementary sign with a directional arrow may be placed below the BIKE ROUTE sign. The supplementary plate shall be 24 inches by 6 inches with a white arrow and border on a green background.

2D-49 Traffic Signal Speed Sign (I1-1)

The Traffic Signal Speed sign, reading SIGNALS SET FOR (25) M.P.H., may be used to indicate the beginning of a section of highway on which the traffic control signals are coordinated into a pretimed progressive system and timed for a specified speed at all hours during which they are operated on a stop-and-go basis. Where used, the sign should be mounted on, or as near as possible, to each signal face where the timed speed changes, and at intervals of several blocks throughout any section where the timed speed remains constant.

This sign shall be a minimum of 12 inches by 18 inches with the longer dimension vertical. It shall always have a white reflectorized message and border on a green reflectorized background.

2D-50 General Information Signs (I Series)

Of interest to the traveler, though not directly necessary for his guidance, are numerous kinds of information that may properly be conveyed by information signs. They include such items as State lines, city limits, and other political boundaries, stream names, elevations, landmarks and similar items of geographical interest. Such



12
Variable Size



13
Variable Size



14
24" x 24"
24" x 6"

signs should not be installed within a series of guide signs or at other equally critical locations, unless there are specific reasons for orienting the highway user or identifying control points for activities that are clearly in the public interest.

On all such signs the design should be simple and dignified, devoid of any advertising and in general conformance with other guide signing.

Such signs shall conform to the general standards for guide signs, and shall be reflectorized where required to provide nighttime visibility.

These signs shall be erected in accordance with the general specifications (secs. 2A-23, 24).

2D-51 Signing of Named Highways

Numbered highways are not to be signed as memorial routes. Where legislatures name highways or bridges, appropriate plaques may be erected in rest areas or at other appropriate points to recognize this designation, but the affected highways and bridges are not to be signed with memorial names for viewing by traffic.

The use of route markers will be restricted to markers officially used for guidance of traffic in accordance with this Manual and the "Purpose and Policy" statement of the American Association of State Highway Officials, which applies to Interstate and U.S. numbered routes. However, the marking of unnumbered routes having major importance to the proper guidance of traffic is permissible if carried out in accordance with the aforementioned policies.

E. GUIDE SIGNS—EXPRESSWAY

2E-1 Scope of Expressway Guide Sign Standards

Specifications for Expressway Guide signs prescribed herein shall apply to any divided highway with partial control of access.

2E-2 Application

Expressways call for an intermediate level of signing more advanced than that prescribed for Conventional Roads (Part II-D), but less demanding in their requirements and specifications than Freeway signing standards (Part II-F). Since there are many geometric design variables to be found in existing expressways, a signing concept commensurate with prevailing conditions must be the primary consideration. Whenever possible, expressway signing should be planned at the design stage.

2E-3 General Standards

Basically, expressway signs should be so designed that they are legible to the drivers of vehicles approaching them, and readable in time to permit a proper response. On arterials and rapid-service facilities of expressway design, this usually means (a) high visibility, (b) large lettering and symbols, and (c) a short legend for quick comprehension. Standardized shapes and colors are used so that the several types of traffic signs can be promptly recognized.

Although the sections which follow deal specifically with expressway guide signs, it must be remembered that the dimensions of regulatory and warning signs will have to be suitably enlarged for the expressway traveler in consideration of multiple traffic lanes and higher operating speeds. Moreover, ground signs in these categories may have to be posted in the median as well as at the right-hand side of the roadway as traffic in the right-hand lane may obstruct the view to the right.

Reference should be made to Part II-A for pertinent data on sign shapes, sign borders, variable messages, overhead sign warrants, height and lateral clearance. Standard messages and symbols for regulatory and warning signs will also apply. (Parts II-B and II-C.)

2E-4 Functions of Expressway Guide Signs

Guide signs on expressways serve a number of distinct functions. These are:

1. Giving directions to destinations, or to streets or highway routes, at intersections or interchanges.
2. Furnishing advance notice of the approach to intersections or interchanges.
3. Directing drivers of vehicles into appropriate lanes in advance of diverging or merging movements.
4. Identifying routes, and directions on those routes.
5. Showing distances to destinations.
6. Indicating access to general motorist services, rest, scenic, and recreational areas.
7. Providing other information of value to the driver.

2E-5 Color of Expressway Guide Signs

Guide signs on expressways except as noted herein shall have white letters, symbols, and borders on a green background. Color requirements for route markers and trailblazers, signs with blank-out or variable messages, signs for services, rest areas, park and recrea-

tional areas, and for certain miscellaneous signs are specified in the individual sections dealing with the particular sign or sign group. Color Tolerance Charts for the standard colors are available.⁸

2E-6 Reflectorization or Illumination

White letters, symbols, and borders shall be reflectorized. The background of expressway guide signs may be reflectorized or non-reflectorized. However, the mixing of signs with reflectorized and nonreflectorized backgrounds in the same general area should be avoided.

In general, where there is no serious interference from extraneous light sources, reflectorized signs will usually be adequate. However, on expressways where much driving at night is done with low beam headlights, the amount of headlight illumination incident to an overhead sign display is relatively small. Therefore, all overhead sign installations should normally be illuminated. The type of illumination chosen should provide effective and reasonably uniform illumination of the sign face and message.

2E-7 Size of Expressway Guide Signs

Sign size must be fixed primarily in terms of the length of the message and the size of the lettering necessary for proper legibility. On a given expressway it is desirable, for esthetic and economic reasons, to keep to a minimum number of sizes.

Under some circumstances, particularly for overhead signs, the available space must be considered. A sign mounted over a particular roadway lane to which it applies may have to be limited in horizontal dimension to the width of the lane, so that another sign may be placed over an adjacent lane. The necessity to maintain proper vertical clearance may place a further limitation on the size of the overhead sign and the copy that can be accommodated.

2E-8 Amount of Legend on Expressway Guide Signs

Regardless of letter size, the legend on an expressway guide sign must be kept to a minimum. Two destinations and the directional copy are as much as most drivers can comprehend readily at high speed. For this reason, on any single major guide sign, not more than two destination names or street names ordinarily should be shown. A city name and street name on the same sign should be avoided. Directional copy, not exceeding three lines, may include symbols, route numbers, arrows, cardinal directions, and exit instructions. Where two or more signs are placed on the same sup-

⁸ Available from the Federal Highway Administration, Washington, D.C.. 20591.

ports, it is desirable to limit destinations or names to one per sign, or to a total of three in the display. Indiscriminate use of supplemental signs should be avoided (sec. 2E-26).

2E-9 Style of Lettering

The style of lettering to be used on expressway guide signs shall be one of the following two types:

1. Upper-case letters for all word legend; or
2. Lower-case letters with initial upper-case letters for all names of places, streets, and highways and upper-case letters for other word legend.

2E-10 Size of Lettering

Word messages in the legend of expressway guide signs shall be in letters at least 8 inches high. Larger lettering is necessary for major guide signs at or in advance of interchanges and for all overhead signs. Recommended numeral and letter sizes according to interchange classification, type of sign and component of sign legend are shown in table II-1. These sizes are to be regarded as the minimum desirable under favorable conditions. Freeway lettering sizes (table II-2) may be considered applicable to expressways designed closely to freeway geometrics.

For use with lower-case letters, the initial upper-case letters shall be $1\frac{1}{3}$ times the "loop" height of the lower-case letters.

Letter sizes on expressway signs are to be the same for both rural and urban conditions. Space is often at a premium on urban sections, but large easy-to-read copy is just as necessary as on rural highways because of the more complex traffic pattern.

TABLE II-1 Letter and Numeral Sizes for Expressway Guide Signs

	Major*		Inter- mediate*	Minor*	Overhead
	Category (a)*	Category (b)*			
<i>Exit Panel</i>					
Word.....	10"	10"	10"	8"	10"
Numeral.....	15"	15"	15"	12"	15"
Letter.....	15"	15"	15"	12"	15"
<i>Route Marker Interstate</i>					
Numeral.....	18"	-----			18"
Shield					
(1-2 Digit).....	36"x36"	-----			36"x36"
(3 Digit).....	45"x36"	-----			45"x36"

TABLE II-1 Letter and Numeral Sizes for Expressway Guide Signs—Cont.

	Major*		Inter- mediate*	Minor*	Overhead
	Category (a)*	Category (b)*			
<i>U.S. or State</i>					
Numeral.....	18"	18"	18"	12"	18"
Shield					
(1-2 Digit).....	36"x36"	36"x36"	36"x36"	36"x36"	36"x36"
(3 Digit).....	45"x36"	45"x36"	45"x36"	45"x36"	45"x36"
or Alternate (Ex: U.S. 56)					
Initials.....	15"	12"	12"	10"	12"
Numeral.....	18"	15"	15"	12"	15"
<i>Cardinal</i>					
Word.....	15"	12"	10"	8"	12"
<i>Name of Place, Street, or Highway</i>					
Word.....	20"/15"	16"/12"	13.3"/10"	10.6"/8"	16"/12"
<i>Distance</i>					
Numeral.....	18"	15"	12"	10"	15"
Fraction.....	12"	10"	10"	8"	10"
Word.....	12"	10"	10"	8"	10"
<i>Action Message (Exit Direction Signs)</i>					
Word.....	10"	10"	10"	8"	10"

*See Section 2E-21, Expressway Interchange Classification

B. Ground Mounted Gore Signs

At major interchange, category (a)*

Cardinal direction.....	12"
Route marker.....	36"x36"

At major category (b)* and intermediate interchanges

Word.....	10"
Numeral.....	12"

At minor interchange

Word.....	8"
Numeral.....	10"
Letter.....	8"

C. Thru Traffic Signs

"Thru Traffic" Message

Word.....	12"
-----------	-----

Destination Message

Word.....	13.3"/10"
-----------	-----------

TABLE II-1 Letter and Numeral Sizes for Expressway Guide Signs—Cont.

Route Marker as Message

Cardinal Direction.....	10"
Route Marker.....	36"x36"

D. *Supplemental Guide Signs*

Exit Number	
Word.....	8"
Numeral.....	12"
Letter.....	12"
Place name.....	10.6"/8"
Action message.....	8"

E. *Interchange Sequence Signs*

Word.....	10.6"/8"
Distance Numeral.....	10"
Fraction.....	8"

F. *"Next—Exits" Signs*

Place name.....	10.6"/8"
NEXT—EXITS.....	8"

G. *Mileage Signs*

Word.....	8"/6"
Numeral.....	8"

H. *General Motorist Services Signs*

Exit Number	
Word.....	8"
Number.....	12"
Letter.....	12"
Services.....	8"

I. *Rest Area and Scenic Area Signs*

Word.....	10"
Distance	
Numeral.....	12"
Fraction.....	8"
Word.....	10"
Action Message	
Word.....	10"

J. *Mileposts*

Word.....	4"
Numeral.....	10"

K. *Boundary and Orientation Signs*

Word.....	8"/6"
-----------	-------

TABLE II-1 Letter and Numeral Sizes for Expressway Guide Signs—Cont.

L. "Next Exit" and "Next Services" Signs

Word.....	8"
Numeral.....	8"

M. "Exit Only"

Word.....	10"
-----------	-----

2E-11 Interline and Edge Spacing

Interline spacing of upper-case letters should be approximately three-fourths the average of upper-case letter heights in adjacent lines of letters.

The spacings to the top and bottom borders should be approximately equal to the average of the letter height of the adjacent line of letters. The lateral spacing to the vertical borders should be essentially the same as the height of the largest letter.

2E-12 Abbreviations

Abbreviations are to be kept to a minimum. In the case of cardinal directions used with route markers on major guide signs, the words NORTH, SOUTH, EAST, and WEST are not to be abbreviated. This does not apply to branch routes where the suffix letter is an integral part of the route designation, or to interchange numbers that have letters for cardinal direction indications following the exit number.

2E-13 Symbols

Symbol designs should be essentially like those shown in this Manual. Educational plaques (word messages) may be used below symbol signs where needed. A special effort should be made to balance legend components for maximum legibility of the symbol with the rest of the sign legend. Intersection or interchange diagrams (figs. 2-10, 2-11), if used, should be as straightforward and simple as possible.

2E-14 Arrows

On all guide signs, both overhead and ground-mounted, used to direct traffic into an exit roadway, arrows shall point upward at an angle representative of the alignment of the exit roadway.

Downward pointing arrows shall be used only for overhead guide signs to prescribe the use of specific lanes for traffic bound for the destination(s) and/or route(s) indicated by the arrows. In such

cases a separate arrow shall be centered over each lane serving the destination appearing on the sign.

If the lane that is to be used by exiting traffic is also to be used by through traffic, the bottom line of the overhead sign shall contain the legend NEXT RIGHT (LEFT). Unusual design conditions may require the use of other directional messages such as STRAIGHT AHEAD.

Dimensions of arrows for use on guide signs are shown in figure 2-7.

2E-15 Viewing Factors

Proper placement of signs, either overhead or on the ground, can greatly enhance the effectiveness of an installation. Sign faces should always be oriented to minimize specular reflection by a slight turning away from the roadway. Decisions on the placement of signs, both ground-mounted and overhead, should be related to the site conditions. Where highway design features and other appurtenances are affected, sign placement should be jointly planned for best service and safety.

2E-16 Overhead Sign Installations

Overhead sign installations will have value at many locations on expressways. Specifications for the design and construction of structural supports for highway signs have now been standardized by the American Association of State Highway Officials, and other agencies.⁹

Factors justifying the erection of overhead signs are enumerated in section 2A-22.

An overcrossing structure will sometimes serve for the support of overhead signs, and may be the only practical location that will provide adequate viewing distance. Such use of a structure as a sign support will eliminate the need for the foundations and sign supports along the roadside. On an urban expressway where overhead crossings are closely spaced, it may be desirable to place signs on the bridges. Butterfly-type signs, and other overhead sign supports should not be erected in gores or other exposed locations.

2E-17 Urban Expressways

Urban expressways are characterized not so much by physical city limits or other boundary lines, but by factors such as high traffic

⁹ Available from the American Association of State Highway Officials, Washington, D.C. 20004.

volumes, lower operating speeds, closely-spaced interchanges, and roadway lighting.

Operating conditions and road geometrics on urban expressways usually require special sign treatment. This involves the following considerations:

1. Use of Interchange Sequence signs (sec. 2E-31).
2. Elimination of service signing (sec. 2E-33).
3. Reduction to a minimum of post interchange signs (sec. 2E-29).
4. Display of advance signs at distances closer to the interchange, with appropriate adjustment in the legend (sec. 2E-24).
5. Use of overhead signs on roadway structures and independent sign supports (sec. 2E-16).
6. Use of diagrammatic signs in advance of intersections and interchanges (sec. 2E-24).

2E-18 Expressway Guide Sign Classification

Expressway guide signs are classified and treated in the following categories:

1. Route markers and trailblazers (sec. 2E-19).
2. Intersection signs (sec. 2E-20).
3. Interchange signs (secs. 2E-23 to 2E-30).
4. Interchange sequence signs (sec. 2E-31).
5. Next (3) exits area signs (sec. 2E-32).
6. Services signs (sec. 2E-33).
7. Rest area and scenic area signs (sec. 2E-35).
8. Recreational area signs (sec. 2E-36).
9. Milepost markers (sec. 2E-37).
10. Miscellaneous guide signs (sec. 2E-38).

2E-19 Route Markers and Trailblazers

Route markers on expressways ordinarily are incorporated as shields or other distinctive shapes in large directional guide signs. Markers designed for independent mounting have less application on expressways.

Route markers and auxiliary markers showing junctions and turns should be used for guidance on approach roads, for route confirmation just beyond entrances and exits, and for reassurance along the expressway. Where used on the expressway proper, the markers should be suitably enlarged. Dimensional data for route marker shields is given in section 2F-37.

The standard Trailblazer assembly (sec. 2D-34) may have application on roads leading to the expressway. If desired, the component parts of the Trailblazer assembly may be included on a single sign panel.

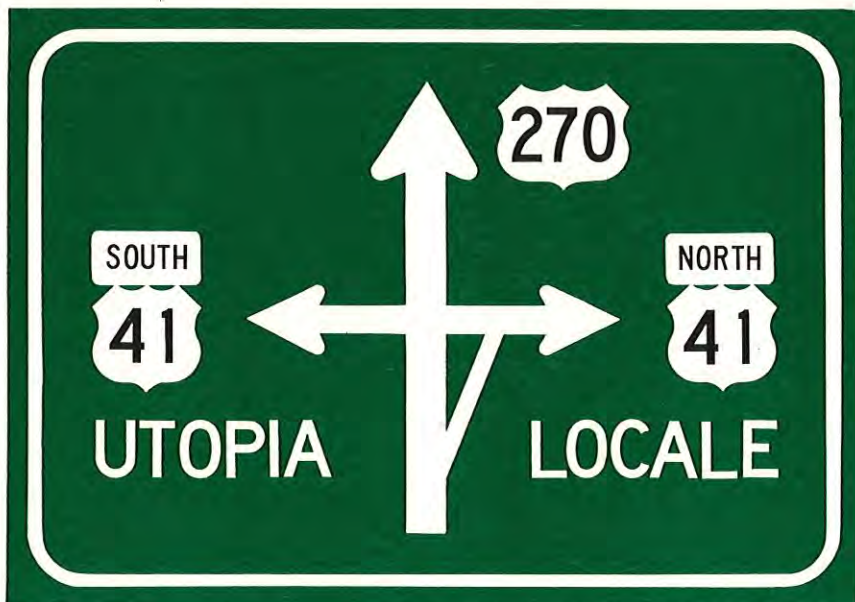


Figure 2-10. Diagrammatic sign for intersection at grade.

2E-20 Signs for Intersections at Grade (fig. 2-10)

Wherever there are intersections at grade within the limits of an expressway, sign types specified in Part II-D will be applicable. However, such signs should be of a size compatible with the level of signing on the expressway as a whole. Advance guide signs for intersections at grade may take the form of diagrammatic layouts depicting the geometrics of the intersection along with essential directional information. A pictorial guide sign of this kind is shown in figure 2-10.

2E-21 Expressway Interchange Classification

For expressway signing purposes interchanges are classed as: major, intermediate and minor.

1. Major interchanges are subdivided into two categories:

- a. Interchanges with other expressways or freeways.
- b. Interchanges, other than those named in (a), with high-volume multilane highways, principal urban arterials, and major rural routes where the interchanging traffic is heavy or includes many drivers unfamiliar with the area.

2. Intermediate interchanges are those with urban and rural routes not in the category of major or minor interchanges, as defined herein.

3. Minor interchanges include those where traffic is local and very light, such as the interchanges with isolated land service roads in the west. Where the sum of exit volumes is estimated to be lower than 100 vehicles per day in the design year, the interchange will be classed as minor.

2E-22 Interchange and Exit Numbering

The feasibility of numbering interchanges or exits on an expressway will depend largely on the extent to which grade separations are provided. Where there is appreciable continuity of interchange facilities, interrupted only by an occasional intersection at grade, the numbering will be helpful to the expressway traveler.

Where used, the interchange numbering shall conform to the milepost numbering system prescribed for freeways (sec. 2F-20). The exit number legend, if used, shall be white letters and numerals (table II-1) on a green background and shall appear on interchange guide signs as hereinafter described in sections 2E-24 through 2E-31 and as shown in figures 2-11, 2-15, and 2-18.

2E-23 Interchange Guide Signs

Interchange guide signs, in proper sequence, combine the functions of separate Route Markers and Destination signs, previously described in Part II-D, to give all necessary guidance through interchanges. For each interchange there should be a minimum of three guide signs (or assemblies of guide signs) and a maximum of five, not including any duplicate signs placed on the left side of the roadway to supplement the regular signs. In all cases major guide signs placed in advance of the interchange deceleration lane should be spaced at least 800 feet apart. Sections 2E-24 through 2E-33 describe, in order, the signs that should appear at the approach to, at and beyond each interchange.

2E-24 Advance Guide Signs (fig. 2-11)

The advance guide sign gives notice well in advance of the exit point of the principal destinations served by the next interchange and the distance to that interchange.

For major interchanges two advance guide signs should be used. The recommended distance for their placement is one and two miles. The legend on the sign shall be the same as on the Exit Direction sign except that the last line shall read EXIT 1 MILE or EXIT 2 MILES as the case may be. If the interchange has two or more exit roadways, the bottom line shall read EXITS 1 (2) MILE(S).

EXITS 33 A-B

E1-5 Exit Number Panel



E1-1



E1-1a

Note: Delete word EXIT(S) if exit number is used.



E1-2



E1-3



E1-4

Figure 2-11. Typical interchange advance guide signs.

However, where exit numbers are used, the word EXIT will be omitted from the bottom line. It may not always be desirable to locate the sign at the exact 1 and 2 mile point from the interchange. In such case the distance shown should be to the nearest $\frac{1}{4}$ mile. Fractions of a mile, rather than decimals, should be shown in all cases. Where the distance between interchanges is less than two miles, the two-mile sign will be omitted.

At intermediate interchanges, two advance guide signs should be used, with appropriate distance indications, to give the driver a total of three notices of the exit destinations. As previously indicated, the sign location may be adjusted for interchange spacing and other conditions, subject only to a minimum allowable distance of 800 feet between the advance guide sign and the exit direction sign.

At minor interchanges, only one advance guide sign is required. It should be located $\frac{1}{4}$ to $\frac{1}{2}$ mile from the exit gore.

Recommended letter and numeral sizes for advance guide signs are shown in table II-1. Where appropriate, diagrammatic signing of a type shown in figure 2-11 may be used either as a substitute for or in addition to the above-described signs.

2E-25 Next Exit Supplemental Sign (fig. 2-12)

Where the distance to the next interchange is such that a driver failing to make a desired turn would be required to travel a number of miles out of his way, it may be desirable to use a supplementary panel mounted below the advance guide sign nearest the interchange. This will carry the legend NEXT EXIT (12) MILES. Where this sign is used, it shall be placed below the guide sign nearest the interchange. Normally, the Next Exit sign should not be used unless the distance between successive interchanges is more than 5 miles.

The legend for the Next Exit sign may be displayed in either one or two lines. The one-line message is the more desirable choice.



E2-1



E2-1A

Figure 2-12. Next exit supplemental advance guide sign.

However, where the sign is to be mounted below the advance guide sign, the two-line message should be used if the one-line message will cause the sign to have a horizontal dimension greater than that of the principal sign.

2E-26 Other Supplemental Signs (fig. 2-13)

Information regarding destinations accessible from an interchange, other than places shown on the standard interchange signing, may be shown on a supplemental guide sign. Such a sign may list one or two destinations followed by the legend NEXT RIGHT or SECOND RIGHT or both, as appropriate. The supplemental guide sign installation should be erected approximately mid-way between the two major advance guide signs. If only one advance guide sign is used, the supplemental sign should follow by at least 800 feet. Where exit numbers are used, the NEXT RIGHT or similar action message is unnecessary.

Supplemental signing can impair the effectiveness of other guide signing because of the possibility of overloading the driver's capacity



E3-1

Figure 2-13. Other supplemental advance guide signs.

to receive and make decisions on visual messages. For this reason each jurisdiction should develop an appropriate policy for such signing. Such items as population and distance from the expressway route and the significance of the destination should be taken into account.

Only one supplemental guide sign may be used on each interchange approach. It is to be located as an independent sign installation rather than being added to any of the major guide signs.

2E-27 Exit Direction Signs (fig. 2-14)

The exit direction sign repeats the route and destination information that was shown on the advance guide sign(s) for the next exit, and thereby assures the driver of the destination served and indicates whether he leaves on the right or on the left for that destination.

The sign for exit direction should be located at least 500 feet in advance of the theoretical gore point. It should be placed either at the beginning of the deceleration lane or at a location approximately $\frac{1}{4}$ to $\frac{1}{2}$ mile in advance of the gore point, usually depending on the visibility of the exit roadway to drivers approaching on the through lanes of the expressway.

When the sign is located at or near the beginning of the deceleration lane and the alignment of the exit ramp is so conspicuous that



E4-1



E4-2



E4-3

Figure 2-14. Interchange exit direction signs.

an arrow symbol will be readily associated with the departure point and ramp alignment, the upward pointing directional arrow, appropriately included for the exit roadway alignment, shall be incorporated into the sign. When these conditions are not met or when the sign is located well in advance of the beginning of the deceleration lane, the directional word message NEXT RIGHT (or NEXT LEFT) shall be used in lieu of the directional arrow.

In some cases, principally in urban areas, visibility obstructions due to structures, unusual alignment, or closely spaced interchanges may make it impossible to locate the exit direction sign, either with the arrow or with the action message, without violating the required minimum spacing between major guide signs. In such circumstances, interchange sequence signs (sec. 2E-31) may be substituted for the exit direction or advance guide sign.

Letter, numeral and arrow sizes are presented in table II-1 and figure 2-7.

2E-28 Gore Signs (figs. 2-15, 2-16)

The gore sign indicates the place of departure from the main-line roadway. Therefore, consistent application of this type of sign according to design conditions is of much importance. The basic need is for a sign to indicate the exiting point. Each gore should be treated similarly, whether the interchange has one exit roadway or multiple exits. Requirements for ground-mounted and overhead sign installations are considered separately.

The ground-mounted gore sign is located in the area between the main roadway and the ramp at all exits which do not have overhead gore signs. It may be used to supplement the overhead sign where this is necessary for delineation or other purposes. The following



Figure 2-15. Ground-mounted gore exit signs.



E6-1



E6-2



E6-3



E6-3a

Figure 2-16. Overhead gore exit signs.

provisions govern the design and application of the ground-mounted gore sign:

1. The sign shall carry the word **EXIT**, or **EXIT** with a number (if interchange or exit numbering is used), and an arrow (figure 2-7).

2. In cases where special emphasis is needed to identify the exit roadway, such as at the second exit of a multiple exit interchange, the sign may consist of a route marker, cardinal direction plate and arrow.

3. In no case should the sign present information not previously displayed on approach signs to the interchange exit.

4. Breakaway or yielding supports should be used for ground-mounted gore signs because of their vulnerability at this location to vehicles out of control.

The overhead gore sign is located at or close to the theoretical gore point. The following provisions govern its design and application.

1. The sign shall carry the exit number (if used), the route number, cardinal direction and destination, with an appropriate upward-sloping arrow (figure 2-7).

2. At a multi-exit interchange the sign should be located directly over the exit roadway for the first exit. At the same location and normally over the right-hand through lane, an exit direction sign

for the second exit should be located. A sign over the lane or lanes farthest to the left may also be used for the through movement. For such a sign, the words THRU TRAFFIC with or without a down arrow may be displayed with the appropriate route number or control city destination, or both.

3. Overhead gore signs may also be used effectively at the second exit. If the second exit is beyond an underpass, the sign should ordinarily be mounted on the face of the overhead structure so as to give motorists adequate visibility of the exit message. When the expressway route is on an overcrossing, the gore sign should be on a cantilever support over the exit lane in advance of the gore point.

4. Where the distance between interchanges is short, advance guide signs for a given interchange have to be placed near or at the preceding interchange. In these circumstances, the overhead gore sign at the exit may also have as a companion sign over the through lanes, the advance guide sign for the next interchange.

5. The message EXIT ONLY (sec. 2E-38) may be used on the overhead gore sign to advise drivers of a lane drop situation.

2E-29 Post-Interchange Signs

Where space between interchanges permits, as in rural areas and where undue repetition of messages will not occur, a fixed sequence of signs should be displayed beginning 500 feet beyond the end of the acceleration lane. At this point there should be a route marker, followed 1,000 feet farther along by a speed limit sign, and this followed in another 1,000 feet by a mileage sign.

Where space between interchanges does not permit placement of these three post-interchange signs without encroaching on or overlapping the advance guide signs necessary for the next interchange, or in rural areas where the interchanging traffic is primarily local, one or more of the post-interchange signs should be omitted. Usually the mileage sign will be of less importance than the other two and can, therefore, be omitted especially where interchange sequence signs are used. If the sign for through traffic on an overhead assembly already contains the route marker, the post-interchange route marker may also be omitted.

2E-30 Mileage Signs (fig. 2-17)

Where used, the post-interchange mileage sign shall consist of a two- or three-line sign carrying the names of significant destination points and the distances to those points. Destination points should be selected and arranged as follows:

1. The top or first line of the sign shall identify the next interchange with the name of the community near or through which the



E7

Figure 2-17. Post interchange mileage sign.

expressway route passes, or if there is no community, the route number or name of the intersected highway.

2. A second line may be used on the sign, and when used, should be reserved for communities of general interest which are on or immediately adjacent to the route or major traffic generators that the route was specifically located to serve. The choice of names for the second line, when it is used, can be varied on successive mileage signs to give motorists maximum information concerning communities served by the expressway.

3. The third, or bottom line, shall contain the name and distance to a control city (if any) which has national significance for travelers using the expressway route.

Under normal conditions, mileages to the same destinations should not be shown more frequently than at five-mile intervals. The mileages displayed on these should be the actual distance to the destination points and not to the exit from the expressway.

2E-31 Interchange Sequence Signs (fig. 2-18)

Where exits are very closely spaced, particularly through large urban areas, interchange sequence signs identifying the next two or three interchanges by name or route number, are useful. Mileages or fractions thereof to the appropriate interchange are displayed. Such signs should be placed in advance of the first advance guide sign and approximately midway between interchanges.

The interchange sequence sign may also have application for smaller communities served by three or more exits. In these cases,

Santa Barbara Ave	$\frac{3}{4}$
Vernon Ave	$1\frac{1}{2}$
51st Street	$2\frac{1}{4}$

E8-1

Columbia Exits	
College St	$1\frac{1}{2}$
Hanover St	$2\frac{1}{4}$
High St	$2\frac{3}{4}$

E8-1a

Figure 2-18. Interchange sequence signs.

the name of the community followed by the word EXITS should be on the top line and destinations (not to exceed three) and corresponding mileages should be shown below. Interchange exit numbers shall not be shown on interchange sequence signs.

2E-32 Next (3) Exits Area Sign (fig. 2-19)

Expressways may pass through "historical" or "recreational" regions, or urban areas served by a succession of several interchanges. Such regions or areas may be indicated by a special sign several miles, if possible, in advance of the advance guide sign or signs for the first interchange. The sign legend should identify the region or area followed by the words NEXT (3) EXITS or NEXT (3) INTERCHANGES as appropriate.



E9

Figure 2-19. Next (3) exits area sign.

2E-33 Signing for Services (fig. 2-20)

On rural sections of expressways where general motorist services are infrequent, service signing may be needed. In such cases, the provisions of section 2D-46 will apply, except that signs should be suitably enlarged. Letter and numeral sizes are shown in table II-1.



Figure 2-20. Services sign.

Special signs or other displays may be erected in safety rest areas, scenic overlooks, roadside turnouts and similar areas, for providing motorists with specific services information. National criteria for such postings are given in the Federal Register, Vol. 24, No. 15, January 23, 1969.¹⁰

2E-34 Uniform Signing by Type of Interchange

Signing should be consistent for each type of interchange to help motorists identify the geometric layout, as well as to obtain route, direction and destination information for specific exit ramps. Where unusual geometric features exist, sign modifications may be justified, but should be held to a minimum to preserve a pattern of uniformity. Figures 2-27 through 2-33 show applications of guide signs for common types of interchanges.

2E-35 Rest and Scenic Areas

Signing for safety rest areas and for scenic areas should conform to the provisions previously set forth in sections 2D-42 and 2D-43.

¹⁰ National Standards and Criteria for Official Highway Signs Within Interstate Rights-of-way Giving Specific Service Information for the Traveling Public, Part 22, Chapt. I, Title 23—USC (1969).



E 11-1



E 11-1a

Figure 2-21. Exit only panel.

However, the signs should be suitably enlarged for expressway application. Letter and numeral sizes are shown in table II-1.

2E-36 Recreation Area Signs

Recreation area signs of the type described previously in section 2D-44 may have application on expressway facilities. Where such

signs are used, the provisions of that section should be followed with suitable enlargement of the signs for expressway conditions.

2E-37 Milepost Markers

Milepost markers will be required on expressway facilities which are located on a route where there is milepost continuity. In such cases, the provisions of section 2F-36 will apply.

2E-38 Miscellaneous Guide Signs (fig. 2-21)

Miscellaneous guide signs, such as those pointing out geographical features like rivers, summits, and political boundaries may be used on expressways if they do not interfere with signing for interchanges or other critical points. If they are to be of value to the expressway traveler they should be consistent with other expressway signs in design and legibility.

Where Weigh Station signing is applicable on an expressway route the provisions of section 2D-45 should be followed. Suitable adjustment will have to be made in the sizes of the signs and in the posting distance.

A special sign reading **EXIT ONLY** is of value in advising drivers of an imminent lane drop situation. The sign shall have a yellow background with black legend, and may be used on the lower edge or lowest line of overhead gore, exit direction or advance guide signs on roadways approaching an interchange where there is a reduction in the number of available lanes for through traffic.

2E-39 Special Signing on Expressway Approaches and Connecting Roadways

The identification of entrances to expressways from roads of lesser importance should be given adequate attention. Conventional signing on the approach roads, as prescribed in Part II-D, may in some cases be ineffective for some of the more critical interchanges. Under such conditions the expressway signing standards may have to be extended to the approach roads.

Signing for frontage roads need not be to the same standard as is used on the through traffic roadways of the expressway, but otherwise should be consistent with requirements for roadways of this class. Good judgment and careful attention to details of such signs and their locations must be exercised in the vicinity of ramp terminals to avoid giving drivers confusing or conflicting information, or creating sight obstructions.

F. GUIDE SIGNS—FREEWAYS

Section 2F-1 Scope of Freeway Sign Standards

Specifications for Freeway Guide signs prescribed herein shall apply to any Expressway with full control of access, including the National System of Interstate and Defense Highways. These standards, with the exception of certain markers reserved exclusively for the Interstate Highway System, provide a uniform and effective system of highway signing that will be fully adequate for high-volume, high-speed motor vehicle traffic on all modern freeways. The specific requirements for the Interstate Highway System,¹¹ as developed and approved by the American Association of State Highway Officials, have been incorporated herein with amendments to provide in one document standards now applicable to all streets and highways.

Existing toll roads incorporated in the Interstate System are not required to comply with the standards defined herein until major replacements are necessary. However, full uniformity in traffic control devices is a national goal, and the earliest practicable compliance with the standards on those facilities should be obtained.

Where appropriate, to reduce redundancy, reference is made to other applicable sections of Part II for selected specifications for freeway signing.

2F-2 Freeway Signing Principles

The development of a signing system for freeways must be approached on the premise that the signing is primarily for the benefit and direction of drivers who are not familiar with the route or area. The signing must furnish drivers with clear instructions for orderly progress to their destinations.

Sign installations are an integral part of the freeway facility and, as such, must be planned concurrently with the development of highway location and geometric design. Plans for signing must be analyzed during the earliest stages of preliminary design and details correlated as final design is developed.

Interstate routes are not to be signed as memorial highways. This provision does not prohibit the erection and maintenance of memorial plaques indicating the highway is, for instance, a Blue Star Memorial Highway, if such plaques are placed in rest and recreational areas within or adjacent to the right-of-way of Interstate highways which have been designated as a memorial highway by State law or by official administrative action by the State highway department.

¹¹ *Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways*, 1970, American Association of State Highway Officials, Washington, D.C. 20004.

The naming of a bridge or highway on the Interstate System to recognize an individual or group of individuals is not to be recognized as a part of the official signing of the Interstate Highway System.

Under no conditions shall an Interstate route, that is officially designated as a memorial highway by State legislative or State highway administrative action, have signs erected along the route carrying the memorial name of the highway.

Except where they interfere with signing for interchanges or other equally critical points, miscellaneous guide signs of various types may be used to show State, county and other significant local jurisdictional boundaries. Signs of this character should not be installed unless there are specific reasons for orienting the users of the freeway or identifying control points for activities that are clearly to the public interest.

On all such signs the design should be simple and dignified, devoid of any tendency toward flamboyant advertising and in general conformance with other freeway signing.

2F-3 General Characteristics of Freeway Signing

Freeway signing should always be considered and developed as a planned system of installations. Engineering study will be necessary for proper solution of the problems of many individual locations, but, in addition, consideration of an entire route is necessary. The excessive signing found on many major highways usually is the result of using a multitude of signs too small and poorly designed and placed to accomplish the purpose intended.

Drivers should be confronted with consistent signing on the approaches to interchanges, as they drive from one State to another, and when driving through rural or urban areas. Geographical, geometric, and operating factors regularly create significant differences between urban and rural freeway conditions, and the signing must take these into account.

The standards prescribed for sign letter size on freeways are the same for both urban and rural areas. Space is often at a premium on urban sections, but the typical traffic pattern is also more complex for the driver to negotiate, and large easy-to-read copy is, therefore, just as necessary as on rural highways. The lower speeds characteristic of urban operation may well support consideration of different highway geometrics in design, but do not justify different sign standards.

2F-4 Characteristics of Urban Freeway Signing

The distinctive characteristics of freeway interchange signing for urban conditions are outlined in section 2E-17.

Urban conditions are characterized not so much by reason of physical city limits or other arbitrary boundaries, as by some or all of the following features:

1. Mainline roadways with more than 2 lanes.
2. High traffic volumes on the through roadways.
3. High volumes of entering and leaving traffic at certain interchanges.
4. Interchanges closely spaced.
5. Roadway lighting at some or all interchanges, and sometimes continuous lighting.
6. Three or more interchanges serving the major city.
7. A loop, circumferential or spur serving a sizable portion of the urban population.

2F-5 Characteristics of Rural Freeway Signing

Rural signing ordinarily benefits from greater distances between interchanges. This permits adequate spacing for the sequences of signs on the approach to and departure from each interchange. The tendency to group all signing in the immediate vicinity of rural interchanges should be avoided by considering the entire route in the evolution of sign plans. Extra effort should be given to the placement of signs at natural target locations to command the attention of the driver, particularly when the message to be conveyed has a high relative priority.

Rural sections of freeways are subjected to high speed traffic. The absence of traffic in adjoining lanes and on entering or leaving ramps, often adds monotony to rural driving. This increases the importance of signs and markings that call for decision or action. Accordingly, where there are long distances between interchanges and the alignment is relatively unchanging, signs should be positioned for their best effect on drivers.

2F-6 Sign Layouts

There should be general adherence to the prescribed horizontal and vertical sequences for route markers, cardinal directions, destination names, arrows and other components of the sign display. The present standards are intended to result in nationwide uniformity and yet contain provisions flexible enough for most signing problems. Minor departures may be necessary when symbols are employed.

2F-7 Diagrammatic Signs (figs. 2-22, 2-23)

Diagrammatic or symbol signs have shown promise not only for application to warning and regulatory type messages but also for certain freeway guide signs. The use of diagrammatic signing at



Figure 2-22. Sample diagrammatic sign for cloverleaf interchange.



Figure 2-23. Sample diagrammatic sign for directional interchange.

interchanges offers a rapid way of conveying to the driver the maneuvers which are required to reach a given destination. A pictorial representation of this kind may have special value at large complex interchanges where a motorist may be confronted with

multiple exits, both left and right off-ramps, or where he is required to make more than one maneuver to reach his chosen destination.

Symbol designs are encouraged for freeway application and shall be essentially like those shown in this Manual. Interchange diagrams, if used, should be as straight forward and simple as possible.

This Manual does not prescribe specifications for diagrammatic signing, but samples of such signs are shown in figures 2-22 and 2-23. Highway departments are encouraged to develop and experiment with diagrammatic signing (sec. 1A-5) and to carefully evaluate installations where it is used so that specific standards may be incorporated in future editions of the Manual. Guidelines for designing these signs are available.¹²

2F-8 Designation of Destinations

Freeways offer superior traffic service to population centers located on or near them. For this reason, the course of the freeway route and the major destinations or "control cities" along it must always be clearly identified. Destination legends should provide the drivers the best orientation possible. Continuity in successive sign messages and consistency with available map information are essential.

National guidelines for the selection of control cities are not available; accordingly, each State should determine its list of control cities in cooperation with adjacent States with the objective of achieving continuity in signing. Any given route should have the same control cities for both directions of movement, although "satellite" cities may be selected for movements outbound from a major urban area, while only that area will be signed for approaching traffic.

The determination of major destinations or control cities will be important to the quality of service provided by the freeway, and control city legends should be used in the following situations:

1. Interchanges between freeways;
2. Separation points of overlapping freeways;
3. On directional signs on intersecting routes, to guide traffic entering the freeway;
4. As an alternate to the THRU TRAFFIC message;
5. On the bottom line of post interchange mileage signs.

2F-9 Limit on Destination Legends

Destination names and directional information must not exceed the amount of copy that most drivers will be able to comprehend readily. The limitations on destination legends described in section

¹² Available from the Federal Highway Administration, Washington, D.C. 20591.

2E-8 shall apply to major guide signs on freeways. Population figures or other similar information on exit guide signs should not be used.

2F-10 Routing to a Given Destination

A route diverging from a freeway should not be posted with any of the same destination names as are shown at that point for the freeway route. At any decision point, a given destination should be indicated over only one route.

2F-11 Overhead Sign Installations

Overhead signs have application in lieu of or as an adjunct to ground signs when engineering study indicates that they are needed. Factors which may justify the erection of overhead signs are enumerated in section 2A-22. In addition to those listed, lane drops and left exit ramps are also to be considered. These factors should be evaluated to arrive at decisions to erect overhead signs.

Information relative to the design of sign structures has been standardized by the American Association of State Highway Officials, and other agencies.¹³

Use of overcrossing structures for the support of overhead signs is described in section 2E-16.

2F-12 Style of Lettering and Legend Spacing

Letter style and height, and arrow design have been standardized for freeway signs to assure uniform and effective application. With all freeway signs, the message dimensions shall be determined first, and the outside sign dimensions secondarily. The prescribed numeral and letter sizes according to interchange classification and component of sign legend appear in table II-2. Other sign letter size requirements not specifically identified elsewhere in this Manual should be guided by these specifications.

All names of places, streets, and highways on freeway guide signs shall be composed of lower-case letters with initial upper-case letters. The initial upper-case letters shall be $1\frac{1}{3}$ times the "loop" height of the lower-case letters. Other word legends shall be in upper-case letters. Suitable designs for upper-case and lower-case alphabets are available, together with tables of recommended letter spacing, from the Federal Highway Administration.¹⁴ The initial letters

¹³ Available from the American Association of State Highway Officials, Washington, D.C. 20004.

¹⁴ Available from the Federal Highway Administration, Washington, D.C. 20591.

and the numerals used will be Series E(M) of the Standard Alphabets for Highway Signs (Series E modified by widening the stroke width to approximately one-fifth of the letter or numeral height).

Interline and edge spacing shall be as specified in section 2E-11.

Abbreviations are to be kept to a minimum. The provisions of sections 2A-14 and 2E-12 shall apply.

TABLE II-2 Letter and Numeral Sizes for Freeway Guide Signs

A. Advance Guide, Exit Direction, and Overhead Gore Signs

	Major*		Inter- mediate*	Minor*	Overhead Gore
	Category (a)*	Category (b)*			
Exit Panel					
Word----	10"	10"	10"	10"	10"
Numeral_	15"	15"	15"	15"	15"
Letter---	15"	15"	15"	15"	15"
Route Marker					
Interstate					
Numeral_	24"	18"	-----		18"
Shield					
(1-2 Digit)-	48"x48"	36"x36"	-----		36"x36"
(3 Digit)---	60"x48"	45"x36"	-----		45"x36"
U.S. or State					
Numeral_	24"	18"	18"	12"	18"
Shield					
(1-2 Digit)-	48"x48"	36"x36"	36"x36"	24"x24"	36"x36"
(3 Digit)	60"x48"	45"x36"	45"x36"	30"x24"	45"x36"
or Alternate					
(Ex: U.S. 56)					
Initials--	15"	15" 12"	12"	10"	12"
Numeral_	18"	18" 15"	15"	12"	15"
Cardinal					
Word----	15"	15" 12"	12"	8"	12"
Name of Place, Street, or Highway					
Word----	20"/15"	20"/15"	16"/12"	16"/12"	13.3"/10" 16"/12"
Distance					
Numeral_	18"	18" 15"	15"	12"	15"
Fraction_	12"	12" 10"	10"	8"	10"
Word----	12"	12" 10"	10"	8"	10"
Action Message (Exit Direction Signs)					
Word	12"	12"	12"	8"	12"

*See Section 2E-21, Interchange Classification

Note: (|) Vertical bar signifies separation of desirable and minimum sizes.

(/) Slanted bar signifies separation of upper-case and lower-case alphabets.

B. Ground Mounted Gore Signs

At major interchange, category (a)*

Cardinal direction.....	12"
Route marker.....	36"x36"

At major (category b)- and intermediate interchanges

Word.....	12"
Numeral.....	18"

At minor interchanges

Word.....	8"
Numeral.....	10"
Letter.....	8"

C. Thru Traffic Signs

"Thru Traffic" Message

Word.....	15"
-----------	-----

Destination Message

Word.....	16"/12"
-----------	---------

Route Marker as Message

Cardinal Direction.....	12"
Route Marker.....	16"x36"

D. Supplemental Guide Signs

Exit Number

Word.....	10"
Numeral.....	15"
Letter.....	15"

Place name.....	13.3"/10"
-----------------	-----------

Action message.....	10"
---------------------	-----

*See Section 2E-21, Interchange Classification

E. Interchange Sequence Signs

Word.....	13.3"/10"
Distance Numeral.....	13.3"
Fraction.....	10"

F. "Next-Exits" Signs

Place name.....	13.3"/10"
NEXT-EXITS.....	10"

G. Mileage Signs

Word.....	8"/6"
Numeral.....	8"

H. General Motorist Services Signs

Exit Number

Word.....	10"
Number.....	15"
Letter.....	15"
Services.....	10"

I. Rest Area and Scenic Area Signs

Word.....	12"
-----------	-----

Distance	
Numeral.....	15"
Fraction.....	10"
Word.....	12"
Action Message	
Word.....	12"
J. Mileposts	
Word.....	4"
Numeral	10"
K. Boundary and Orientation Signs	
Word.....	8"/6"
L. "Next Exit" and "Next Services" Signs	
Word.....	8"
Numeral.....	8"
M. "Exit Only"	
Word.....	10"

2F-13 Sign Borders

Signs shall have a border of the same color as the legend, to outline their distinctive shape and thereby give them easy recognition and a finished appearance. For guide signs larger than approximately 10 feet by 6 feet, the border should have a width of approximately 2 inches. For guide signs smaller than 10 feet by 6 feet, a width of approximately 1¼ inches may be used, but the width should not generally exceed the stroke width of the major lettering on the sign.

Corner radii of sign borders should be approximately one-eighth of the minimum dimension on guide signs, except that the radii should not exceed 12 inches on any sign. The sign area outside the corner radius need not be trimmed.

2F-14 Color, Reflectorization, and Illumination

Color, reflectorization and illumination of freeway guide signs shall conform to the provisions for expressway guide signs set forth in sections 2E-5 and 2E-6. In addition, the background of all overhead signs that are not independently illuminated shall be reflectorized.

Technological developments have produced a variety of types of illumination for highway signs. Internally illuminated signs, having translucent faces, are especially effective for freeway use. Their use may be justified for some installations. Where internal illumination is used, the sign colors shall appear essentially the same by night and by day.

2F-15 Sign Arrows

The design and application of arrows for freeway guide signs shall be the same as that specified in section 2E-14 for expressway signs. Dimensional detail for "Up" and "Down" arrows is shown in figure 2-7.

2F-16 Viewing Factors

The requirements set forth in section 2E-15 concerning placement of signs for effective viewing shall apply to freeway signing.

2F-17 Vertical Clearance

In ground installations, directional signs shall, except as noted below, be erected at a minimum height of 7 feet above the edge of the pavement to the bottom of the sign. If a sign is mounted below another sign, the major sign shall be at least 8 feet and secondary sign at least 5 feet above the level of the pavement edge.

When signs are positioned away from the pavement edge to increase roadside safety, the vertical clearance on such signs may be reduced to 5 feet above the pavement edge. Notwithstanding the above, all route markers and warning and regulatory signs shall be at least 6 feet above the level of the pavement edge.

Overhead signs shall have a vertical clearance of not less than 17 feet to the sign, light fixture, or sign bridge, over the entire width of the pavement and shoulders except that where a lesser vertical clearance is used for design of other structures the vertical clearance to overhead signs, light fixtures, or sign bridges need not be greater than one foot in excess of the clearance at other structures. In special cases it may be necessary to reduce the vertical clearance still further because of substandard dimensions in tunnels and other major structures such as double-deck bridges.

2F-18 Horizontal Clearance

To provide a roadside recovery area for out-of-control vehicles, liberal horizontal clearances should be provided for roadside signs and overhead sign supports. No specific minimum clearance is established, but in no case shall any part of the sign or sign structure, which is within the applicable vertical clearance dimension and which is exposed to traffic, be less than 2 feet beyond any surface prepared for normal or emergency travel of vehicles.

Rigid criteria for lateral clearances should not be followed, but advantage should be taken of the longitudinal location of existing guardrail, overcrossing structures and similar conditions to lessen

the exposure to traffic of signs and sign supports. Breakaway or yielding supports should be located as far from the traveled portion of the roadway as feasible.

Light standards may be used in place of separate sign supports to accommodate the installation of smaller signs and route markers wherever this is practicable.

2F-19 Interchange Classification

For freeway signing purposes, interchanges are classed as major, intermediate, or minor. These terms are defined in section 2E-21.

2F-20 Interchange Exit Numbering (figs. 2-24 through 2-26)

The milepost numbers along freeways provide valuable orientation for the driver, and the appropriate milepost number shall be used in signing each interchange exit. The general plan for numbering interchange exits is shown in figures 2-24 through 2-26.

Interchange exit numbers shall be displayed with each advance guide sign, the exit direction sign, and the gore sign. They may be used with supplemental guide signs and service signs. The milepost exit number preferably will be displayed on a separate panel at the top of the major sign, or at a location below the major sign where conditions make this more practical. Details of typical panel designs are shown in figures 2-11 and 2-15 and, as incorporated on guide signs, in figures 2-27 through 2-35.

Subject to the exceptions noted herein, the standard exit number legend shall include the word EXIT in 10-inch capital letters. The appropriate milepost number shall be in 15-inch numerals and the suffix letter "A" or "B" (on multi-exit interchanges) in 15-inch capital letters in a single-line format on a panel 24 inches in vertical dimension.

Consistent with the AASHO action to adopt the consecutive numbering system for the Interstate System and with the Federal requirement for a milepost numbering system, the two systems may be combined by displaying an auxiliary panel with a single line legend "MILE (number)—EXIT (number)" in conjunction with the advance guide, exit direction and overhead gore signs. For the ground-mounted EXIT gore sign that already displays a consecutive number, the auxiliary panel will read only "MILE (number)."

A general upgrading of the design of milepost installations is prescribed in Section 2F-36. With this improvement the association of mileposting and interchange exit numbers will help to keep the road user aware of his location and the progress of his trip toward a selected exit.

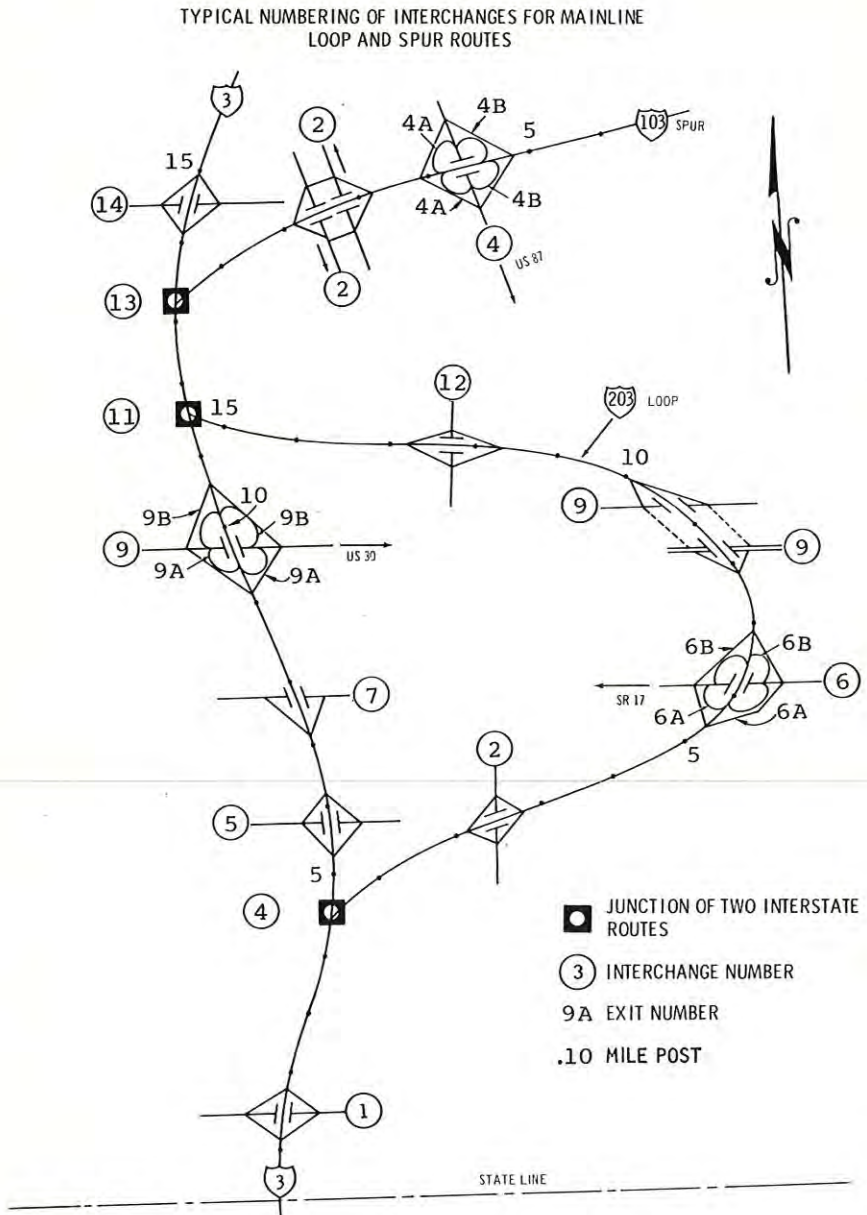


Figure 2-25. Typical interchange numbering for mainline loop and spur routes.

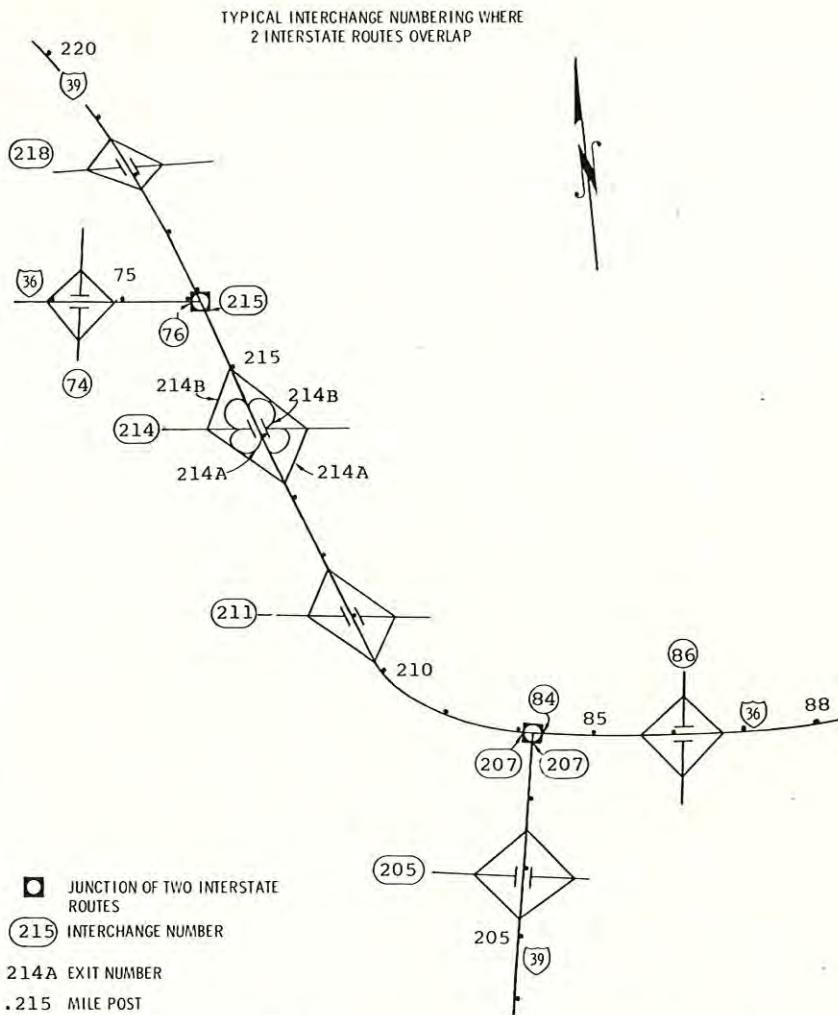


Figure 2-26. Typical interchange numbering where freeway routes overlap.

route, or some other conspicuous landmark in the circumferential near a south polar location. (See figure 2-24.)

The interchange numbers on loop freeway routes shall begin at the loop interchange nearest the south or west main line junction and increase in magnitude toward the north or east main line junction. Spur route interchanges shall be numbered in ascending order starting at the interchange where the spur leaves the main line of the principal freeway route. (See figure 2-25.)

Where numbered freeway routes overlap, continuity of interchange numbering shall be established for only one of the routes. Either route may be selected, but the one chosen should also have continuity in mileposting. (See figure 2-26.)

2F-21 Interchange Guide Signs

As in the case of expressways with grade separations, the major signs at freeway interchanges and on their approaches are advance guide signs, exit direction signs and gore signs. It is essential that the same destination messages be displayed on these three types of signs. New destination information should not be introduced into the major sign sequence for one interchange, nor should information be dropped.

Reference should be made to sections 2E-24 through 2E-32 for a detailed description of the signs, in order, that should appear at the approach to and at each interchange. Supplemental guide signing should be used sparingly as provided in section 2E-26. Letter and numeral sizes for freeway interchange signs are shown in table II-2.

2F-22 Post Interchange Signs

Where space between interchanges permits, a fixed sequence of post interchange signs should be displayed. The provisions of sections 2E-29 and 2E-30 apply to the use and placement of these signs.

2F-23 Signing by Class of Interchange

Motorists need signs to help identify the geometric layout of interchanges, as well as to obtain route, direction and destination information for specific exit ramps. Signing layouts, therefore, must be consistent for each type of interchange. For the sake of uniform application the significant features of the signing plan for each of the more frequent kinds of interchanges, as described in sections 2F-23 through 2F-30 and illustrated in figures 2-27 through 2-33, should be followed as closely as possible. Where unusual geometric features exist, variations in signing layout are permissible, but should be held to a minimum.

The interchange layouts shown in most of the figures illustrate only the major guide signs for one direction of traffic on the through road and on the crossroad.

2F-24 Interchanges Between Freeways (fig. 2-27)

Interchanges between freeways are major decision points where the effect of taking a wrong ramp cannot be easily corrected. Reversing direction on the crossroad or reentering to continue on the intended course is usually not possible. The sign messages should contain only the route shield, cardinal direction, and the name of the next control city on that route. Where routes overlap in a way that requires the naming of two control cities, signing should be as shown in figure 2-27.

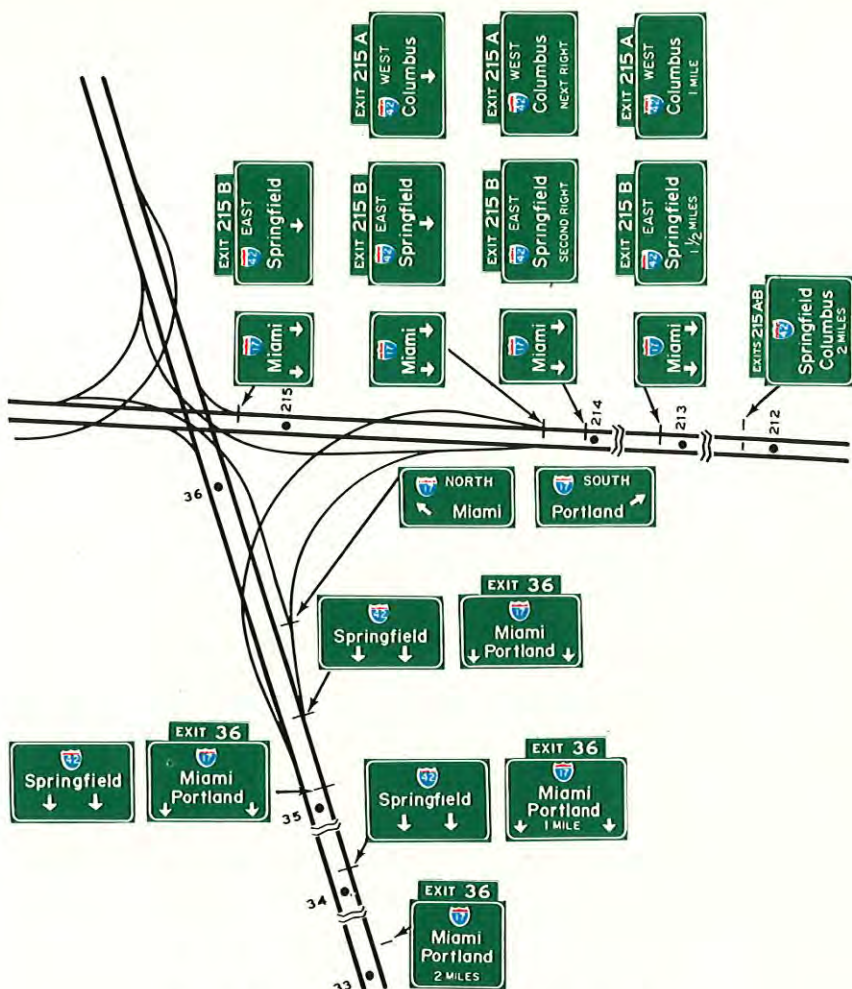


Figure 2-27. Interchange between freeway routes.

Overhead signs are required at a distance of one mile and at the theoretical gore of each connecting ramp, and may be used at the two mile point and in the normal location of exit direction signs. Arrows should point as indicated in section 2D-8, unless a diagrammatic representation of the interchange layout requires otherwise. The name of the control city and/or arrow may be omitted on signs which indicate the straight-ahead continuation of a route. A ground-mounted sign showing the route shield, cardinal direction and arrow may be mounted in the gore, in the position normally occupied by the ground mounted exit gore sign.

Warning signs with the message RAMP (35) MPH shall be used where appropriate, rather than EXIT (35) MPH as on other type interchanges.

The advance guide signs should include two place names, one corresponding to each exit ramp, with the name of the place served by the first exit on the upper line. An overhead sign shall be placed at the theoretical gore point of the first exit ramp, with an upward-sloping arrow on the sign for that exit and the message **NEXT RIGHT** on the sign for the second exit, as shown in figure 2-28. Alternately, the exit messages may be included on a single sign, with only one route shield, as shown in figure 2-29. Over the left lane(s), a sign containing the name of the next control city and/or the Route Marker shield (with or without a cardinal direction) or the message **THRU TRAFFIC** may be used.

The second exit shall be indicated by an overhead exit gore sign over the right-hand through lane, on the structure if the freeway passes under the crossroad, or on a cantilever or full-span structure if the freeway passes over the crossroad. A ground-mounted gore sign may also be used at each exit.

Exit numbers shall not indicate the cardinal directions of the cross route. Multi-exit interchanges shall be numbered as described in Section 2F-20 with an appropriate suffix.



Figure 2-29. Single sign as alternate to two right-hand signs overhead at gore in Figure 2-28.

2F-26 Cloverleaf with Collector-Distributor Roadways (fig. 2-30)

Signing on the collector-distributor roadway shall be basically the same as on a cloverleaf interchange. However, the advance guide signs shall use the singular **EXIT** as shown in the figure.

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2F-27 Partial Cloverleaf (fig. 2-31)

As in the figure, the overhead exit direction sign should be placed on the structure if the freeway passes under the crossroad and the exit roadway is located beyond the structure. A ground-mounted gore sign may also be used.



Figure 2-32. Diamond interchange.

2F-28 Diamond (fig. 2-32)

The signing layout for all interchanges having only one exit ramp in the direction of travel should be similar, regardless of the interchange type (figs. 2-31 through 2-33). The singular message EXIT shall be used on advance guide and exit directional signs. Exit numbers shall not include the cardinal initials corresponding to the direction of the cross route. Only one destination name is necessary, although two may be used.



Figure 2-33. Urban diamond interchange.

2F-29 Urban Diamond (fig. 2-33)

In urban areas, street names are often shown as the principal message in destination signs. If interchanges are too closely spaced

to properly locate the advance guide signs, they may be placed closer to the exit, and the mileage figures adjusted accordingly. Where two or more interchanges serve the same community, the interchange sequence sign is useful in helping motorists make a choice of exits, and may be incorporated in the signing layout, as shown in figure 2-33.

2F-30 Closely Spaced Interchanges (fig. 2-34)

When a series of interchanges is closely spaced, the advance guide sign for the next interchange may be mounted on an overhead structure at the theoretical gore point for the preceding interchange. Information for more than two exits shall not be shown on such signs.

Interchange sequence signs should be utilized, showing street names and distance for the next three exits, as shown in figure 2-34.

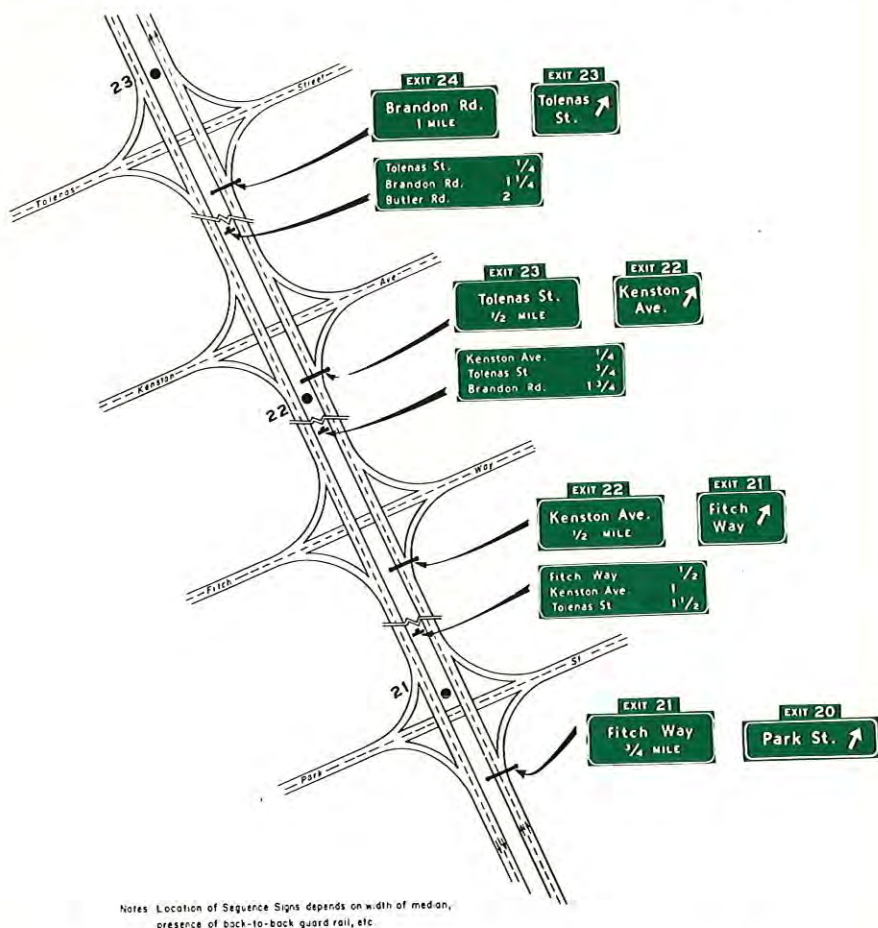


Figure 2-34. Series of closely spaced interchanges requiring sequence signs.

2F-31 Minor Interchange (fig. 2-35)

A lower standard of signing is prescribed for a minor interchange because such an interchange customarily serves low volumes of local traffic only. The size of messages to be used is shown in table II-2.

At least one advance guide sign and a ground-mounted gore sign shall be placed at a minor interchange, as shown in figure 2-35.

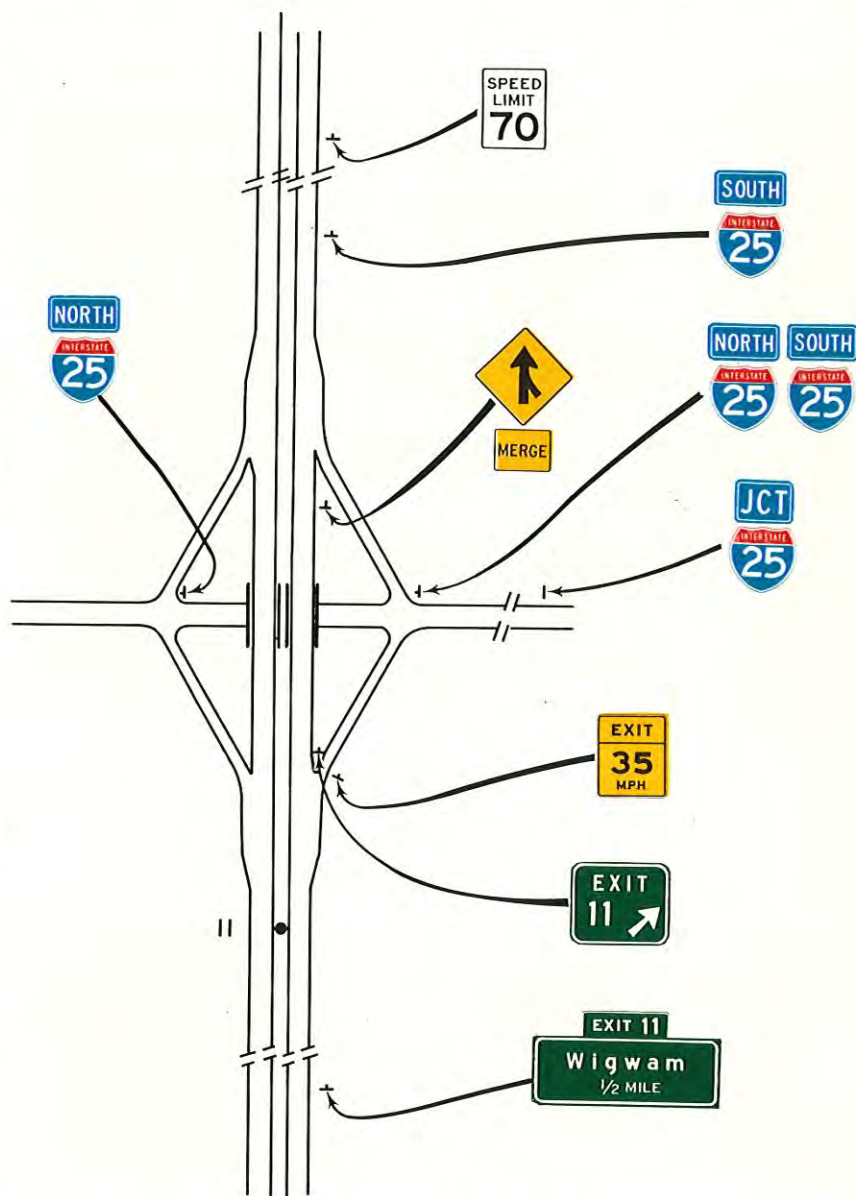


Figure 2-35. Minor interchange.

2F-32 Signing for Services (fig. 2-36)

Inasmuch as freeways are considered here to be highways with full control of access, it is assumed that generally there will be no commercial services available to the traveler between interchanges. It is expected that adequate fuel, motor services, food service and lodging will be available near most major interchange sites. It is also assumed that service signing will not be required in urban areas.



Figure 2-36. Motorist services signs.

However, on those rural sections where such services are infrequent, the driver will need information to enable him to plan his stops.

Only services that adequately serve the needs of the freeway motorist should be shown. Where services are not within sight of the interchange, the road authority may elect to repeat the service signing in smaller size, on the intersecting highway, with arrows indicating the direction to the services. Service signing should only be provided at interchanges where the motorist can return to the freeway and continue in the same direction of travel.

Where road authorities elect to provide service signing there should be a statewide policy for such signing and criteria for the availability of the various types of services. The criteria should include the following:

1. *Gas (and associated services)*

- a. Vehicle services such as fuel, oil, lubrication, tire repair and water.
- b. Restroom facilities and drinking water.
- c. Continuous operation at least 16 hours per day, 7 days a week.
- d. Telephone.

2. *Food*

- a. Licensing or approval, where required.
- b. Continuous operation to serve 3 meals a day, 7 days a week.
- c. Telephone.

3. *Lodging*

- a. Licensing or approval, where required.
- b. Adequate sleeping accommodations.
- c. Telephone.

4. *Telephone*

- a. Continuous operation, 7 days a week.

5. *Hospital*

- a. Continuous emergency care capability, with a doctor on duty 24 hours a day, 7 days a week.

6. *Camping*

- a. Licensing or approval by appropriate public agency.
- b. Adequate parking accommodations.
- c. Modern, sanitary facilities and drinking water.
- d. Signs to be removed if operated on a seasonal basis only.

Freeway signs for services shall conform to the format for general motorist service signs covered in sections 2D-46 and 2E-33 and shown in figure 2-36. Letter and numeral sizes for freeway design are given in table II-2. The services available shall be shown at specific locations on the sign, and the sign space normally reserved for a given service is to be left blank when that service is not present, to

provide flexibility for the future when the service may become available. The standard display recommended is FOOD and PHONE in that order on the top line, and GAS and LODGING on the second line. Where used, HOSPITAL and CAMPING should be on separate lines.

A separate telephone sign (sec. 2D-46) with the word PHONE or the approved symbol may be erected when telephone facilities are located adjacent to the freeway at places where telephones would not normally be expected. The color, general design, location and use of the telephone sign shall conform with the provisions for service signs.

In some locations, signs may be useful to indicate that services are not available.

Tourist information centers have been constructed within rest areas on the Interstate System and other freeways and are operated either by a State or a private organization. Others have been located within close proximity to these facilities and operated by civic clubs, chambers of commerce, or private enterprise.

The following criteria for signing should prevail regardless of the location of the tourist information center:

1. Tourist information centers are regarded as motorist services; therefore, the signing would require the use of white legend and border on a blue background.
2. The name of the operating agency, community, group, or enterprise shall not appear in the legend of any sign.
3. Additional criteria as developed by individual States.
4. Continuous operation eight hours a day, seven days a week. If operated only on a seasonal basis, the signs shall be removed during the off-seasons.

For freeway rest area locations, additional signing criteria are as follows:

1. The location of the advance guide, exit direction, and gore signs is to meet service signing requirements.
2. If the signing for the tourist information center is to be accomplished in conjunction with the initial signing for the rest area, the message may be placed on one sign and should be "REST AREA—TOURIST INFORMATION CENTER—____ MILE(S) or (NEXT RIGHT)."
3. If the initial rest area signing is in place, a supplemental sign should include the legend "TOURIST INFORMATION CENTER." When incorporated in existing sign installations, such panels must be attached so as not to interfere with existing breakaway support action.

4. The gore sign should contain only the legend "REST AREA" with the arrow and not be supplemented with any legend pertaining to the tourist information center.

For information centers located off the Interstate or other freeway facility, the following additional signing criteria shall apply:

1. Each State should have or develop a policy establishing the maximum distance the information center can be located from the interchange in order to be included on official signs.

2. The location of the signing shall be in accordance with requirements pertaining to service signing.

3. Signing along the crossroad should be installed to guide the motorist from the interchange to the information center.

2F-33 Specific Services Information

In addition to the general motorist services signs, State policy may prescribe the use of special panels or displays to provide motorists with specific services information, according to the national criteria for such postings given in the Federal Register, Vol. 24, No. 15, January 23, 1969.¹⁵ These installations may consist of the following:

1. Specific information panels located so as to be readable from the main traveled way approaching an interchange, giving the name, brand or trademark of the services available at that interchange; and/or

2. Roadside area information panels or displays erected in safety rest areas, scenic overlooks, roadside turnouts and similar areas, so as not to be readable from the main traveled way, and giving the name, brand or trademark of services available at interchanges preceding the next roadside area.

2F-34 Rest and Scenic Area Signs (fig. 2-37)

On the approach to rest areas, an advance guide sign shall be placed one mile or two miles in advance of the rest area. Between the advance guide sign and the gore of the rest area exit, there may be a sign reading REST AREA which shall carry either an arrow or the words NEXT RIGHT as a part of the message.

At the rest area exit, there shall be a sign with a message REST AREA together with an arrow indicating the appropriate turn as shown in figure 2-37. All signs for rest areas shall have reflectorized white letters, symbols, and borders on a blue background.

¹⁵ National Standards and Criteria for Official Highway Signs Within Interstate Rights-of-way Giving Specific Service Information for the Traveling Public, Part 22, Chapt I, Title 23—USC (1969).

Scenic area signing should be consistent with that specified for rest areas. Standard messages should read SCENIC AREA or SCENIC VIEW or the equivalent.



Figure 2-37. Freeway rest area gore sign.

2F-35 Weigh Station Signing (fig. 2-38)

Weigh station signing on freeways shall be the same as that specified in section 2D-45, except for lettering size and advance posting distance. The recommended sign layouts and posting distances for freeway application are shown in figure 2-38.

2F-36 Milepost Markers

Milepost signs shall be placed on all freeway facilities and shall conform to the general provisions for mileposts contained in section 2D-47. Markers shall contain 10-inch white numerals on 12-inch wide vertical green panels with a white border. Panels shall be

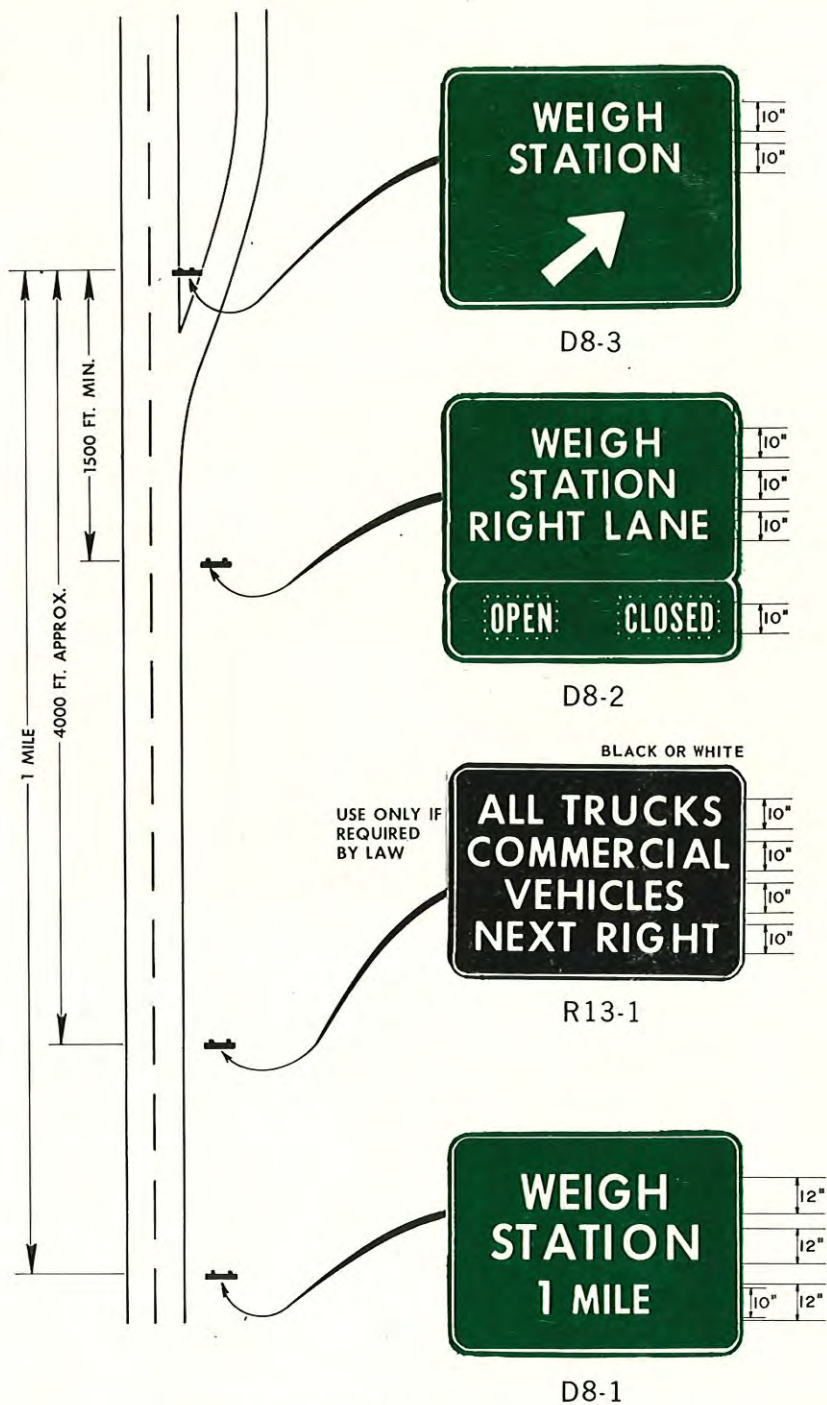


Figure 2-38. Weigh station signing on freeways.

24", 36", or 48" in length for one, two, or three digits, respectively, and contain the word MILE. Mileposts shall be located in line with delineator posts with the bottom of the marker at the same height as the delineator. The mileage numbering shall be continuous for each route within any State except where overlaps occur. With overlapped routes, continuity shall be established for one of the routes which should also have continuity in the interchange exit numbering (sec. 2F-20). On the route without milepost continuity, the first milepost beyond the overlap should be such as to indicate the total distance traveled on the route so that a motorist may have a means of correlating his travel distance between mileposts with that shown on his odometer.

2F-37 Route Markers and Trailblazers (figs. 2-39 through 2-41)

As in the case of expressways (sec. 2E-19), route markers on freeways will ordinarily be incorporated as shields or other distinctive shapes into large directional guide signs. The use of independent markers on freeways will be limited primarily to route confirmation assemblies as shown in figures 2-28, 2-30 and 2-33. The designs of route marker shields for guide sign use and independent use are shown in figures 2-39 through 2-41.

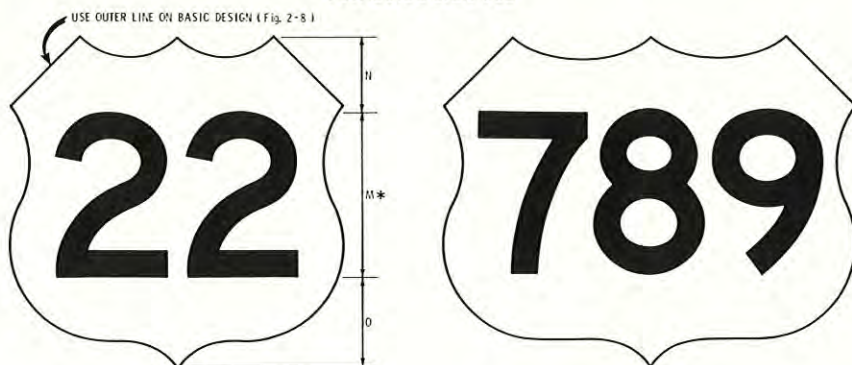
The official route marker for the Interstate Highway System is the red, white and blue reflectorized distinctive shield adopted by AASHO on August 14, 1957. Where the Interstate shield is displayed in an assembly or on the face of a guide sign with US or State route markers, the Interstate numeral should be at least equal in size to these other route markers. The Interstate shield may be either fully reflectorized or only in the numerals and border. However, where it is part of a reflectorized background sign, it shall be fully reflectorized.

The standard Trailblazer assembly (sec. 2D-34) will usually have application on roads leading to a freeway. Where there are gaps between completed sections of a freeway route, the trailblazer assembly should be used to indicate the best routing between the termini of the completed sections.

The commonly used name or trailblazer symbol for a toll facility may be displayed on free sections of the Interstate System at:

1. The last exit before entering a toll section of the Interstate System;
2. The interchange or connection with a toll facility, whether or not the toll facility is a part of the Interstate System; and
3. At other locations within a reasonable approach distance of toll facilities when the name or trailblazer symbol for the toll fa-

FOR GUIDE SIGN USE



*In a few cases numerals cannot be accommodated within the space available. For these situations, the standard Series D numeral may be reduced to Series C, or as a second choice to the next smaller height commonly available.

	M*	N	O
24 x 24	12	5 1/2	6 1/2
30 x 24	12	5 1/2	6 1/2
36 x 36	18	8 1/4	9 3/4
45 x 36	18	8 1/4	9 3/4
48 x 48	24	11	13
60 x 48	24	11	13

FOR INDEPENDENT USE

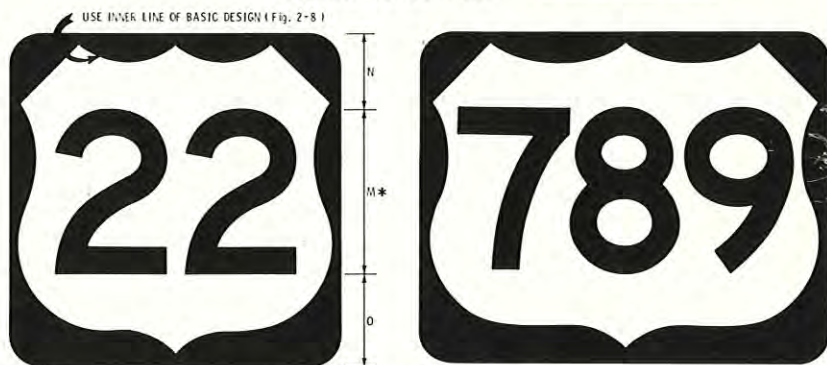


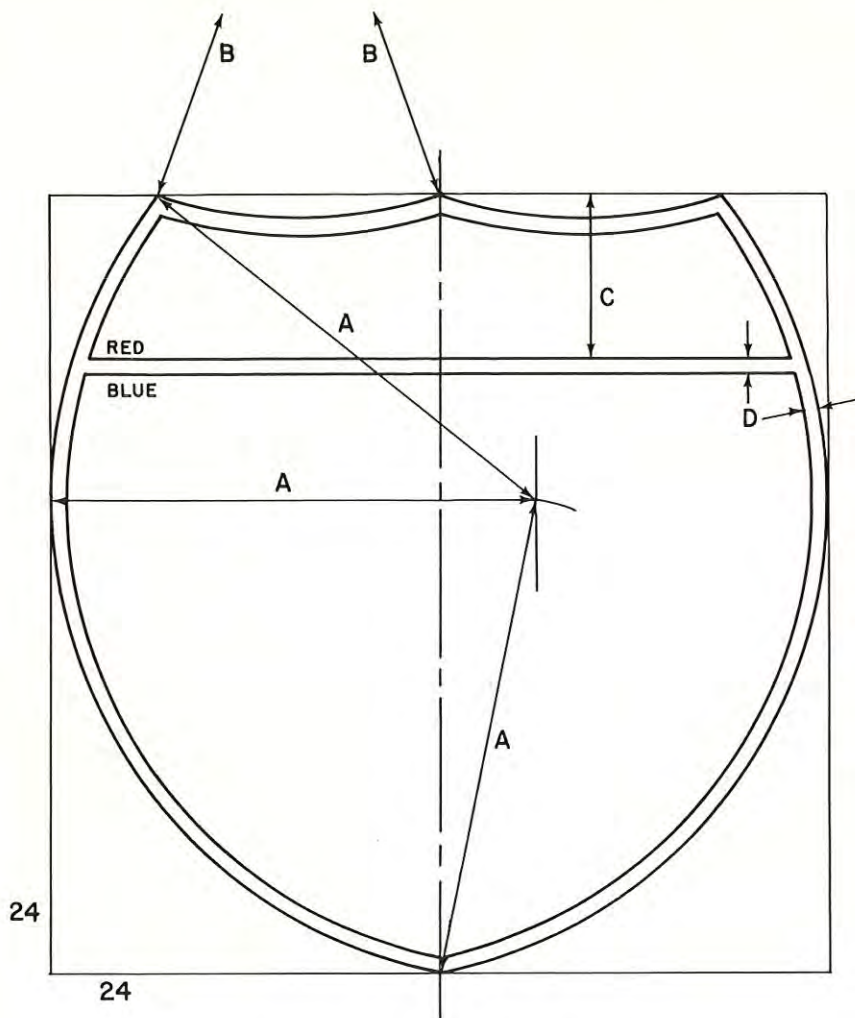
Figure 2-39. Design of U.S. shields.

cility would provide better guidance to drivers unfamiliar with the area than would place names and route numbers.

The toll facility name or marker may be included as a part of the guide sign installations on intersecting highways and approach roads to indicate the interchange with a toll section of an Interstate highway. Where needed for the proper direction of traffic, a trailblazer for a toll facility that is part of the Interstate System may be displayed with the Interstate trailblazer assembly.

2F-38 Miscellaneous Freeway Guide Signs

Certain other guide signs, in addition to those previously discussed, may be used on freeways if they do not interfere with sign-



	A	B	C	D
24 X 24	15	15	5	$\frac{1}{2}$
30 X 24	17	24	5	$\frac{1}{2}$
36 X 36	$22\frac{1}{2}$	$22\frac{1}{2}$	$7\frac{1}{2}$	$\frac{3}{4}$
45 X 36	$25\frac{1}{2}$	36	$7\frac{1}{2}$	$\frac{3}{4}$
48 X 48	30	30	10	1
60 X 48	34	48	10	1

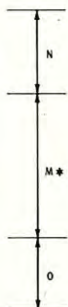
Figure 2-40. Design of Interstate shields.

ing for interchanges or other critical points. These include the types described in sections 2E-36 and 38.

The EXIT ONLY panel described in sec. 2E-38 may be used in either of the forms shown in figure 2-21. A down arrow shall always

be used in combination with these panels. The white arrow should be used between the separate panels EXIT and ONLY and above or below the single panel. If it is desired to utilize a full width

FOR GUIDE SIGN USE



* In a few cases numerals cannot be accommodated within the space available. For these situations, the standard Series D numeral may be reduced to Series C, or as a second choice to the next smaller height commonly available.

	M*	N	O
24 x 24	12	6 1/2	5 1/2
30 x 24	12	6 1/2	5 1/2
36 x 36	18	9 3/4	8 1/4
45 x 36	18	9 3/4	8 1/4
48 x 48	24	13	11
60 x 48	24	13	11

FOR INDEPENDENT USE



	D	E	F	G	H*
24 x 24	1 1/2	2 1/2	1	1 1/2	10
30 x 24	1 1/2	2 1/2	1	1 1/2	10
36 x 36	3/4	3 3/4	1 1/2	2 1/4	15
45 x 36	3/4	3 3/4	1 1/2	2 1/4	15
48 x 48	1	5	2	3	20
60 x 48	1	5	2	3	20



SPUR

Figure 2—41. Interstate Shields and Off-Interstate markers.

yellow background on the bottom of the guide sign, a black down arrow of standard dimensions shall be placed between the words EXIT and ONLY.

Supplemental guide signs with a white legend and border on a brown background may be used when a park or recreational area is being signed as a significant destination for users of the Interstate and other freeway systems. The same color combination can be used for advance guide and exit direction signs for an interchange where the crossroad leads exclusively to a park or recreational area.

Where the crossroad is a numbered route or leads to other destinations, the advance guide and exit direction signs shall retain the white on green color combination. All ground-mounted gore signs shall remain with a white legend on a green background. The background color of interchange exit number panels shall match the color of the guide sign proper.

2F-39 Signing on Freeway Approaches

Freeway signing standards may have to be extended to the approach roads for some of the major interchanges. Frontage roads need not be signed to freeway standards, but otherwise should be consistent with requirements for roadways of their particular class.

G. SIGNING FOR CIVIL DEFENSE

2G-1 Civil Defense Emergencies

Advance planning of local action in response to warning of an attack is the responsibility of State and local authorities. The Federal Government will provide guidance to the States as necessitated by changing circumstances. Civil defense signing is a tool of contingency planning. It is not possible to be sure in advance that any hazardous conditions will, or will not occur at any given place. First emphasis must be given to planning the use of the best shelter available at any time. The fallout shelter is the core of civil defense.

Mass evacuation is not a fruitful planning contingency by itself. Evacuation planning without shelter planning is self-defeating. Signing for preattack evacuation to distant shelters may be thought desirable as an alternative for some communities. Contingency planning for postattack evacuation is desirable for all communities. Plans have been developed for the control of highway traffic under emergency conditions such as could result from accidental disaster or enemy attack. Particularly these plans are concerned with possibilities of nuclear warfare.

In the event of disaster there will be a closing of highways that cannot be used, a controlled operation of certain designated high-

ways, the establishing of regulation posts for the expediting of essential traffic, and the provision of emergency centers for civilian aid.

To guide and control highway traffic in an emergency, special highway signs will be needed. The signs here specified have been approved and are here prescribed as standard for use when and where applicable in the civil defense program.

These emergency signs will not permanently displace any of the standard signs that are normally applicable, and as conditions permit they should be replaced or augmented by standard signs.

The nature, scope and operation of emergency highway traffic regulation in time of emergency brought about by an enemy nuclear attack are discussed in "A Guide for Highway Traffic Regulation in an Emergency" available from U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 20591.

2G-2 Design of Civil Defense Signs

For economy in stockpiling and in emergency fabrication all the special civil defense signs, with the exception of the Evacuation Route Marker, are designed for a single size of plate measuring 24 by 30 inches, and have a black legend and border on a white background. The background should be reflectorized.

In an emergency these signs may be needed in large numbers and are for essentially temporary use. Consideration should accordingly be given to their fabrication from any light and economical material that can serve through the emergency period.

Any of these signs may be accompanied by a standard triangular marker for marking areas contaminated by biological and chemical warfare agents and radioactive fallout.

Signs such as "In Case of Enemy Attack this Highway Will be Closed" or "Civil Defense Highway" or "Emergency Route for Civil Defense" shall not be used.

2G-3 Evacuation Route Marker (CD-1)

The Evacuation Route Marker shall be circular, having a minimum outside diameter of 18 inches, carrying a directional arrow and the legend EVACUATION ROUTE. The standard Civil Defense Symbol, CD inscribed in a triangle within a ring, shall appear near the bottom of the sign, with a diameter of $3\frac{1}{2}$ inches. The legend, arrow, symbol, and border shall be in white on a blue background. At least the arrow and border shall be reflectorized. The arrow designs shall include a straight vertical arrow pointing upward, a straight horizontal arrow pointing to left or right, and a

bent arrow pointing to left or right for advance warning of a turn. The arrow may be a separate unit attached to the face of the sign. The marker format may also be used on a nonreflectorized, white, square plate.

The Evacuation Route Marker, with the appropriate arrow, shall be erected 150 to 300 feet in advance of, and at, any turn in an approved evacuation route, and elsewhere for straight-ahead confirmation where needed. In urban areas it shall be mounted at the right of the roadway, not less than 7 feet above the top of the curb, and at least 1 foot back from the face of the curb. In rural areas it shall be not less than 5 feet above the crown of the roadway and 6 to 10 feet to the right of the roadway edge.

Evacuation Route Markers shall not be placed where they will conflict with normal signs. Where conflict in placement would occur between the Evacuation Route Marker and a standard regulatory sign, the latter shall take precedence. In case of conflict with a standard informational sign the civil defense sign may take precedence.

Placement of Evacuation Route Markers should be made under the supervision of the officials having jurisdiction over the placement of normal traffic signs, but coordination with Civil Defense authorities and agreement between contiguous political entities will be necessary to assure continuity of routes.

2G-4 Area Closed Sign (CD-2)

The AREA CLOSED sign shall be used to close a roadway entering an area from which all traffic is excluded because of dangerous radiological or biological contamination. It shall be erected on the shoulder as near as practicable to the right-hand edge of the roadway, or preferably on a portable mounting or barricade partly or wholly in the roadway. For best visibility, particularly at night, its height should not normally exceed 4 feet from the pavement to



CD-1
18" diameter (blue)



CD-2
30" x 24"

the bottom of the sign. Unless adequate advance warning signs are used, it should not be so placed as to create a complete and unavoidable blockade. Where feasible, the sign should be located at an intersection that provides a detour route.

2G-5 Traffic Regulation Post Sign (CD-3)

The STOP-TRAFFIC REGULATION POST sign shall be used to designate a point where an official post has been set up to impose such controls as are necessary to limit congestion, expedite emergency traffic, exclude unauthorized vehicles, or protect the public. It shall be erected in the same manner as the Area Closed sign (sec. 2G-4) at the point where traffic must stop to be checked.

The standard R-1 STOP sign shall be used for this mandatory stop restriction. The supplemental panel TRAFFIC REGULATION POST should be mounted directly below the STOP sign and shall consist of a black legend on a reflectorized white background.



CD-3
30" x 30"
30" x 24"



CD-4
24" x 30"

2G-6 Emergency Speed Sign (CD-4)

The MAINTAIN TOP SAFE SPEED sign may be used on highways where radiological contamination is such as to limit the permissible exposure time for occupants of vehicles passing through the area. Since any speed zoning would be impractical under such emergency conditions, no minimum speed limit can be prescribed by the sign in numerical terms. Where traffic is supervised by a traffic regulation post, official instructions will usually be given verbally, and the sign will serve as an occasional reminder of the urgent need for all reasonable speed.

The sign should be erected at random intervals as needed, in the same manner as other standard speed signs. In rural areas it shall be mounted on the right-hand side of the road with its lower edge not less than 5 feet above the crown of the roadway, 6 to 10 feet from the roadway edge. In urban areas the height shall be not less than 7 feet, and the nearest edge of the sign shall be not less than 1 foot back from the face of the curb. Where an existing Speed Limit sign is in a suitable location, the Top Safe Speed sign may conveniently be mounted directly over the face of the older sign, which it supersedes.

2G-7 Road Use Permit Sign (CD-5)

The ROAD USE PERMIT REQUIRED FOR THRU TRAFFIC sign is to be used at an intersection, at the entrance to a route on which a traffic regulation post is located. Its intent is to notify drivers of the presence of the post so that those who do not have priority permits issued by designated authorities can detour on another route, or turn back, without making a needless trip and without adding to the screening load at the post. Local traffic, without permits, may proceed as far as the regulation post. The sign shall be erected in a manner similar to that of the Emergency Speed Sign (sec. 2G-6).



CD-5
24" x 30"



CD-6
30" x 24"

2G-8 Emergency Aid Centers Sign (CD-6)

In the event of emergency, State and local authorities will establish various centers for civilian relief, communication, medical service, and similar purposes. To guide the public to such centers a series of directional signs will be needed. These signs shall carry the designation of the center and an arrow indicating the direction to the center. They shall be erected as needed, at intersections and elsewhere, on the right-hand side of the roadway, at a height in urban areas of at least 7 feet, and not less than 1 foot back from

the face of the curb, and in rural areas at a height of 5 feet, 6 to 10 feet from the roadway edge.

These signs shall carry one of the following legends, as appropriate, or others designating similar emergency facilities:

DECONTAMINATION CENTER
REGISTRATION CENTER
WELFARE CENTER
MEDICAL CENTER

2G-9 Fallout Shelter Directional Sign (CD-7)

The Fallout Shelter directional sign shall be used to direct the public to selected fallout shelters that have been licensed and marked for emergency use. They may be erected on all highways, except those on the Interstate system, when it has been determined that a need exists for such signs upon completion of an approved community shelter planning study.

These guide signs may be used to direct people to fallout shelters in rural areas and the environs of a metropolitan area where shelters have a larger capacity than is required to accommodate the local inhabitants of the surrounding area. The signs may be used to identify different routes to a shelter to provide for rapid movement of large numbers of persons, but as a general rule should not be posted more than five miles from the shelter.

The fallout shelter directional sign should be used sparingly and only in conjunction with approved plans of State and local civil defense directors. The erection of these signs shall conform to established highway signing standards. Where used, the signs shall not be erected in competition with other necessary highway guide and regulatory signs.

The fallout shelter directional sign is a horizontal rectangle, 30 by 24 inches, containing the identifying "public fallout shelter" emblem in the upper left part of the sign. The colors of the emblem are yellow triangles inscribed in a black circle placed on a yellow square. The words "FALLOUT SHELTER"—the directional arrow, the distance to shelter (which can be omitted when appropriate), and the border are in black against a white background.



CD-7
30" x 24"

Part III. MARKINGS

A. GENERAL PRINCIPLES

3A-1 Functions and Limitations

Markings have definite and important functions to perform in a proper scheme of traffic control. In some cases, they are used to supplement the regulations or warnings of other devices such as traffic signs or signals. In other instances, they are used alone and produce results that cannot be obtained by the use of any other device. In such cases they serve as a very effective means of conveying certain regulations and warnings that could not otherwise be made clearly understandable.

Pavement markings have definite limitations. They are obliterated by snow, may not be clearly visible when wet, and may not be very durable when subjected to heavy traffic. In spite of these limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the driver without diverting his attention from the roadway.

3A-2 Standardization of Application

Each standard marking shall be used only to convey the meaning prescribed for it in this Manual. Before any new highway, detour, or temporary route is opened to traffic, all necessary markings should be in place.

Markings required by road conditions or restrictions should be removed or obliterated when those conditions cease to exist or the restrictions are withdrawn. Markings no longer applicable which may create confusion in the mind of the motorist shall be removed or obliterated.

Of growing importance is the tendency of traffic authorities to accommodate variable traffic conditions with different types of operation. For this purpose, signs and signals with the ability to display variable messages have been developed. The use of variable messages in the field of markings, however, has been somewhat more limited and confined to the manual placement of flexible cones and posts, and to a few mechanically-operated devices. It is to be expected that the future will bring forth new, practical methods of conveying variable messages by means of markings. When such

need and opportunity occur, extreme care should be used to adhere to the principles set forth in this Manual.

Markings which must be visible at night shall be reflectorized unless ambient illumination assures adequate visibility. All markings on Interstate highways shall be reflectorized.

3A-3 Materials

The most common method of placing pavement, curb, and object markings is by means of paint; however, a wide variety of other suitable marking materials is available. Materials used should provide the specified color throughout their useful life.

Individual unit markers, generally less than 1" in height, may be used for pavement marking purposes. They may be placed in continuous contact or separated by spaces, a variation in pattern being used to simulate solid and broken lines, with apparent widths as specified in section 3A-6. Raised markers of over 1" in height are sometimes used to form curbs and islands and are discussed in Part V.

Marking material used in the vicinity of pedestrian activity should not present tripping or excessive slipping hazards.

3A-4 Colors

Pavement markings shall be yellow, white, or red in color.

The use of black is permitted in combination with the above colors where the pavement itself does not provide sufficient contrast. This use of black does not establish it as a standard pavement marking color but only as a means of achieving contrast on light-colored pavements.

The colors for pavement marking shall conform to the standard highway colors.

3A-5 General Principles-Longitudinal Pavement Markings

Longitudinal pavement markings shall conform to the following basic concepts:

1. Yellow lines delineate the separation of traffic flows in opposing directions or mark the left boundary of the travel path at locations of particular hazard.
2. White lines delineate the separation of traffic flows in the same direction.
3. Red markings delineate roadways that shall not be entered or used by the viewer of those markings.
4. Broken lines are permissive in character.
5. Solid lines are restrictive in character.
6. Width of line indicates the degree of emphasis.
7. Double lines indicate maximum restrictions.

8. Markings which must be visible at night shall be reflectorized unless ambient illumination assures adequate visibility.

3A-6 Widths and Patterns of Longitudinal Lines

The widths and patterns of longitudinal lines shall be as follows:

1. A normal width line is 4" to 6" wide.
2. A wide line is usually twice the width of a normal line.
3. A double line consists of two normal width lines separated by a discernible space.
4. A broken line is formed by segments and gaps, usually in the ratio of 3:5. On rural highways, a commonly used standard is 15 foot segments and 25 foot gaps. Other dimensions in this ratio may be used as best suit traffic speeds and need for delineation.
5. A dotted line is formed by short segments, normally two feet in length, and gaps, normally four feet or longer.

3A-7 Types of Longitudinal Lines

The following examples illustrate the application of the principles and standards set forth in sections 3A-4 to 3A-6:

1. A normal broken white line is used to delineate the edge of a travel path where travel is permitted in the same direction on both sides of the line. Its most frequent application is as a lane line of a multilane roadway.

2. A normal broken yellow line is used to delineate the left edge of a travel path where travel on the other side of the line is in the opposite direction. A frequent application is as a center line of a two-lane, two-way roadway where overtaking and passing is permitted with due care and caution.

3. A normal solid white line is used to delineate the edge of a travel path where travel in the same direction is permitted on both sides of the line but crossing the line is discouraged and as a pavement edge marking. A frequent application is as a lane line approaching an intersection. A wide solid white line is used for emphasis where the crossing requires unusual care. It is frequently used as a line to delineate left or right turn lanes.

4. A double solid white line is used to delineate a travel path where travel in the same direction is permitted on both sides of the line, but crossing the line is prohibited. It is frequently used as a channelizing line in advance of obstructions which may be passed on either side but not encroached upon.

5. A double line consisting of a normal broken yellow line and a normal solid yellow line delineates a separation between travel paths in opposite directions where overtaking and passing is permitted with care for traffic adjacent to the broken line and is prohibited for

traffic adjacent to the solid line. This is a one direction no-passing marking. It is used on two-way, two- and three-lane roadways to regulate passing and to delineate the edges of a lane in which travel in either direction is permitted (but only as part of a left turn maneuver). In the latter application, the markings are to be placed with the solid lines on the outside and the dashed lines to the inside of the lane. Traffic adjacent to the solid line may cross this marking with care only as part of a left-turn maneuver.

6. A double line consisting of two normal solid yellow lines delineates the separation between travel paths in opposite directions where overtaking and passing is prohibited in both directions. This is a two direction no-passing marking. Crossing this marking with care is permitted only as part of a left-turn maneuver. It is frequently used as a channelizing line in advance of an obstruction which must be passed on the right and to form a channelizing island separating traffic in counter directions.

7. A double normal broken yellow line delineates the edge of a lane in which the direction of travel is changed from time to time. Its use is for a reversible lane.

✓ 8. A normal dotted line is used to delineate the extension of a line through an intersection or interchange area. It shall be the same color as the line it extends.

9. A solid yellow line delineates the left edge of a travel path to indicate a restriction against passing on the left or delineates the left edge of pavement on a divided street or highway to indicate inadequate clear space to the left of the line even for disabled vehicles or for making emergency stops.

3A-8 Transverse Markings

Transverse markings including shoulder markings, word and symbol markings, stop lines, crosswalk lines, and parking space markings shall be white except that:

1. Transverse median markings shall be yellow (sec. 3B-10).
2. Line, word and symbol markings visible only to traffic proceeding in the wrong direction on a one-way roadway shall be red.

Because of the low approach angle at which pavement markings are viewed, it is necessary that all transverse lines be proportioned to give visibility equal to that of longitudinal lines, and to avoid apparent distortion where longitudinal and transverse lines combine in symbols or lettering.

3A-9 Curb Markings

Curb markings fall into two categories: roadway delineation and parking regulations.

B. APPLICATIONS OF PAVEMENT AND CURB MARKINGS**3B-1 Center Lines**

A center line separates traffic traveling in opposite directions. It need not be at the geometrical center of the pavement. In locations where a continuous center line is not required, short sections may be useful on approaches to important intersections, marked crosswalks, or railroad crossings. Center lines are frequently used around curves or over hill crests, to control the position of traffic.

The center line markings on two-lane, two-way highways shall be either:

1. a normal broken yellow line where passing is permitted (#2, sec. 3A-7), or
2. a double line consisting of a normal broken yellow line and a normal solid yellow line where passing is permitted in one direction (#5, sec. 3A-7), or
3. a double line consisting of two normal solid yellow lines where passing is prohibited in both directions (#6, sec. 3A-7).

The center line on undivided highways where four or more lanes are always available, is usually a double solid yellow line.

On a three-lane highway it is preferable to designate two lanes for traffic in one direction and mark it as illustrated in figures 3-1b, 3-1c.

Center lines are desirable on paved highways under the following conditions:

1. In rural districts on two-lane pavements 16' or more in width with prevailing speeds of greater than 35 MPH.
2. In residence or business districts on all through highways, and on other highways where there are significant traffic volumes.
3. On all undivided pavements of four or more lanes.

Center lines are also desirable at other locations where an engineering study indicates a need for them.

Applications of center lines are shown in various illustrations herein, particularly figures 3-1, 3-2, 3-3, 3-4.

3B-2 Lane Lines

Lane lines are used to separate lanes of traffic traveling in the same direction. They should be used:

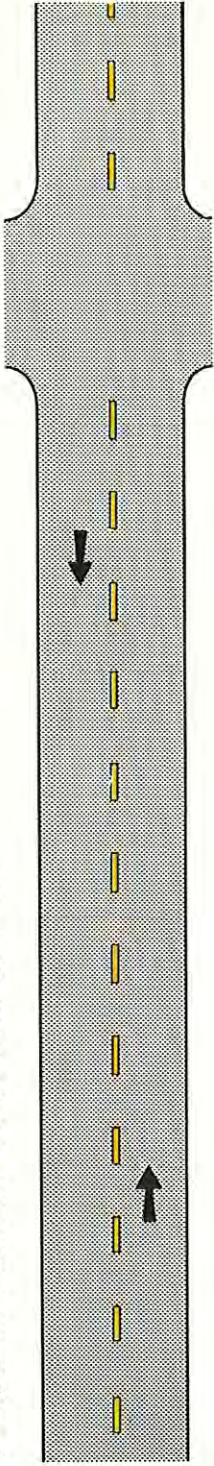
1. On all multi-lane highways.
2. At congested locations where the roadway will accommodate more lanes of traffic than would be the case without the use of lane lines.

Lane lines are usually normal broken white lines which permit lane changing with care.



Figure 3-1. Typical two-way marking applications.

a — Typical two-lane, two-way marking with passing permitted.



b — Typical two-lane, two-way marking with passing prohibited zones.

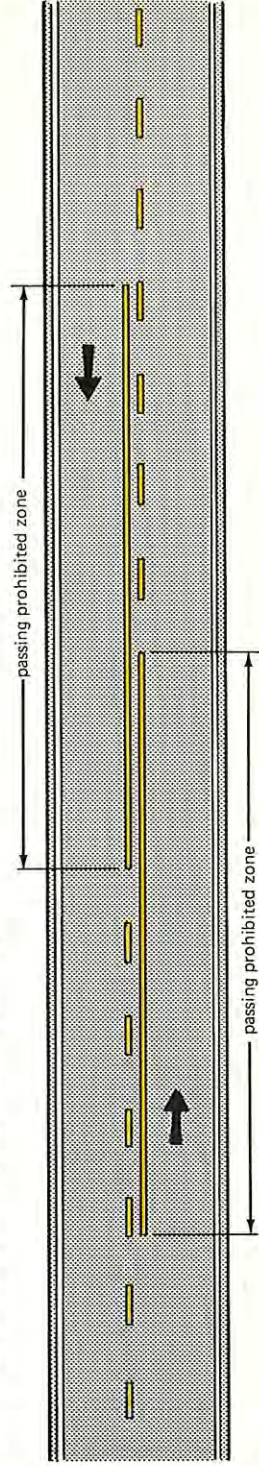
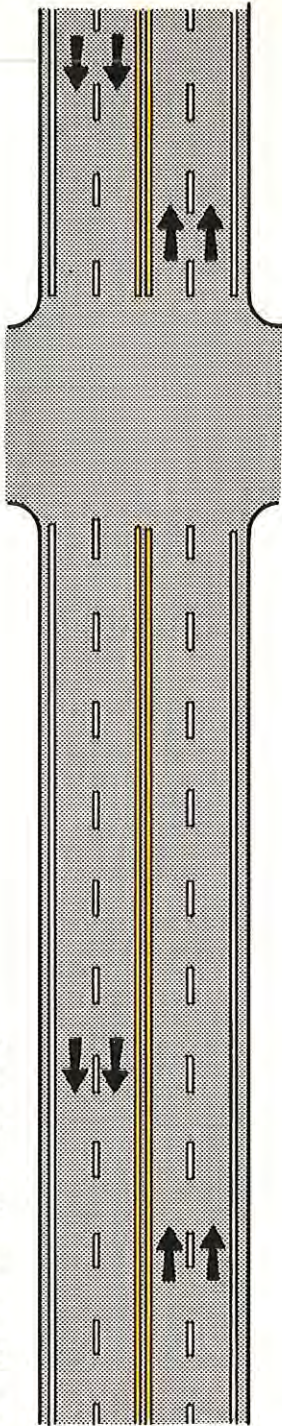


Figure 3-2. Typical 2-lane, two-way marking applications.

a – Typical multi-lane, two-way marking.



b – Typical multi-lane, two way marking with single lane left turn channelization.

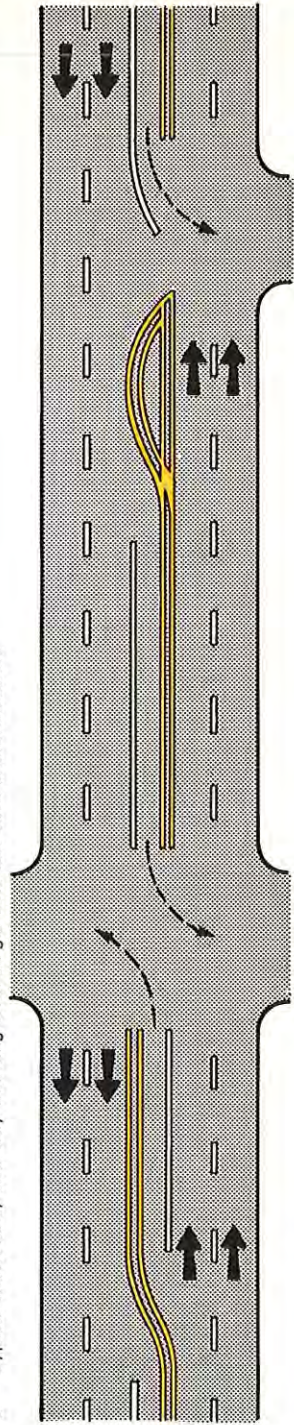
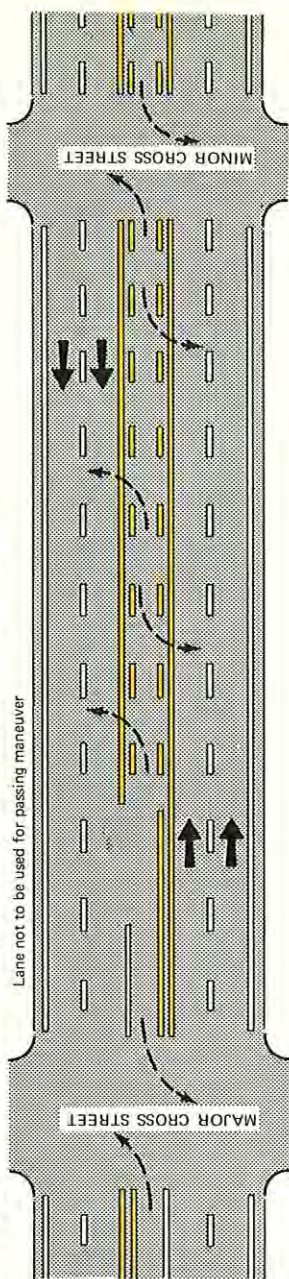


Figure 3-3. Typical multi-lane, two-way marking applications.

a — Typical multi-lane, two-way marking with single lane, two-way left turn channelization.



b — Typical multi-lane, two-way marking with dual lane left turn channelization.

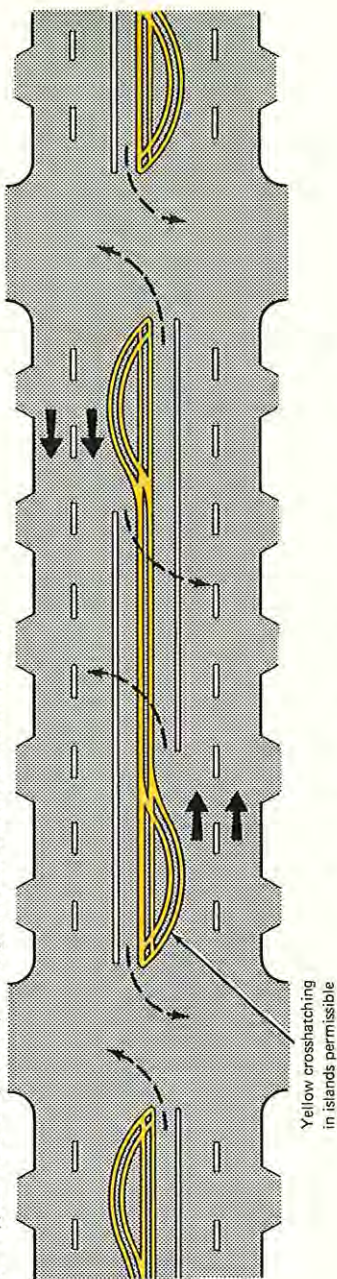


Figure 3-4. Typical multi-lane, two-way marking applications.

A normal solid white line may be used as the lane line in critical areas where it is advisable to discourage lane changing. Typical locations for such applications are tunnels or bridges having width restrictions and interchange areas where lane changing disrupts traffic flow.

A solid white line may be used to separate through traffic lanes from special secondary lanes, such as uphill truck lanes, left or right turn lanes and transit bus lanes.

A double solid white line shall be used when lane changing is prohibited.

The lane width defined by lane lines should normally be 12 feet. However, a reduction is permissible where a maximum number of lanes must be made available for the most efficient movement or storage of vehicles or where low operating speeds prevail.

Applications of lane lines are illustrated in figures 3-1, 3-3, 3-4, 3-5.

3B-3 No-Passing Zone Markings

Where center lines are installed, no-passing zones shall be established at vertical and horizontal curves and elsewhere on two- and three-lane highways where an engineering study indicates passing must be prohibited because of inadequate sight distances or other special conditions. Specific reference is made to section 11-307 UVC Revised—1968.

A no-passing zone shall be marked by either a one direction, no-passing marking (#5, sec. 3A-7) or a two direction, no-passing marking (#6, sec. 3A-7) as illustrated in figure 3-6a.

3B-4 Application of No-Passing Zone Markings

On a two-lane highway, the no-passing marking shall be parallel to and extended along the center line throughout the no-passing zone.

On a three-lane highway where visibility is limited or where the no-passing marking is being moved from one direction to the opposite direction, the no-passing marking shall start in advance of the no-passing zone at the left hand lane line of the center lane and shall extend diagonally across the center lane to the right hand lane line at the beginning of the no-passing zone, and thence extend along the lane line to the end of the zone (fig. 3-6b). An alternate method of marking this condition is illustrated in figure 3-6c.

The no-passing marking shall extend across the center line on a diagonal for a distance computed by the formula $L = S \times W$; where L equals the length in feet, S the 85th percentile speed (off peak) in miles per hour and W the width of the center lane.

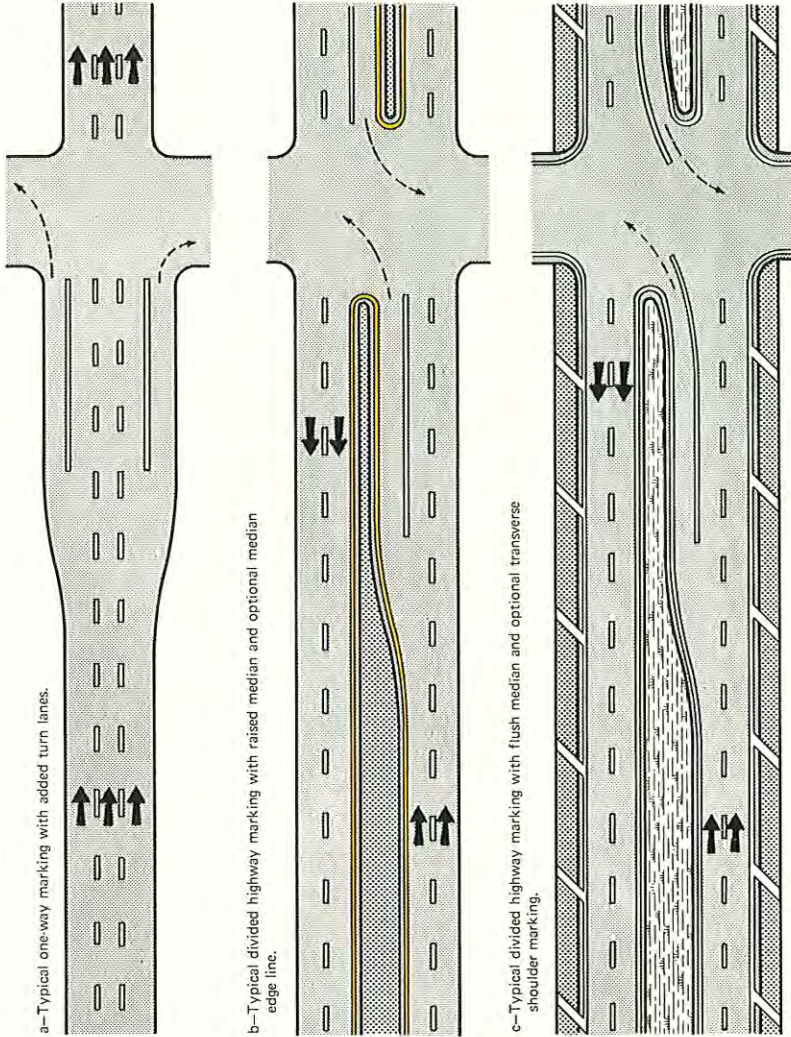


Figure 3-5. Typical one-way and divided highway marking applications

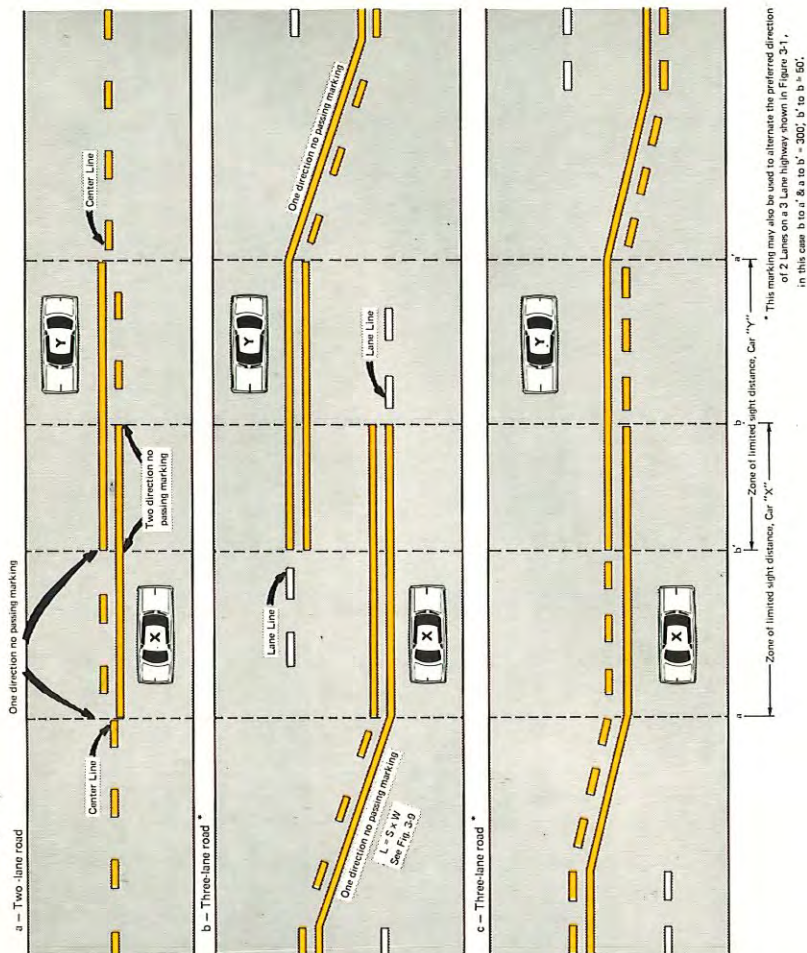
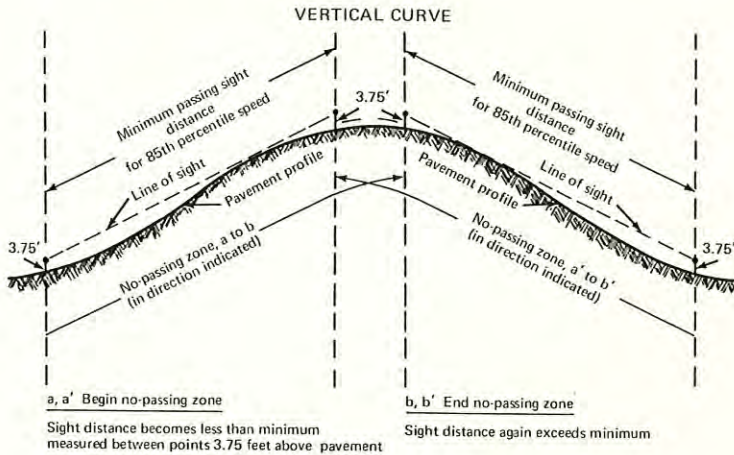


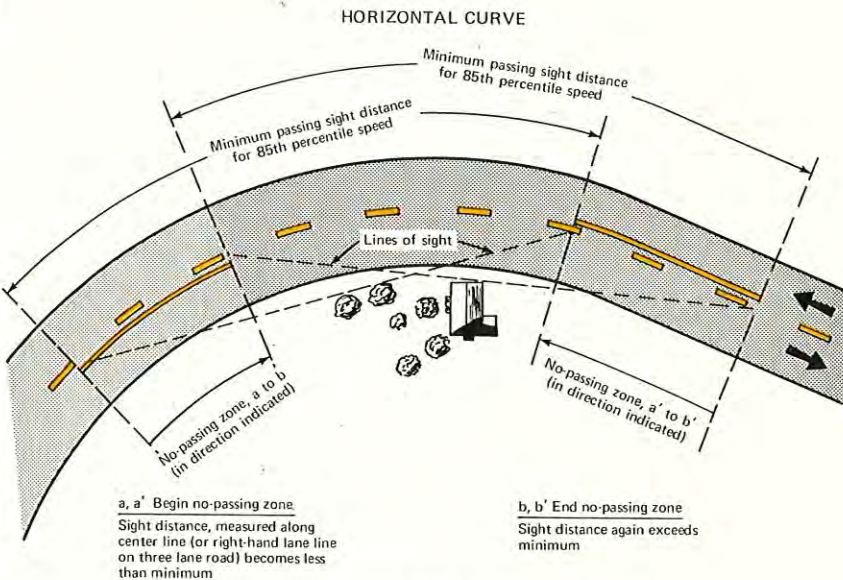
Figure 3-6. Standard pavement marking for no-passing zones.

In addition to the pavement markings here prescribed, no-passing zone signs (secs. 2B-20, 2B-21 and 2C-39) may be used to emphasize the existence and extent of a no-passing zone.

Where the distance between successive no-passing zones is less than 400 feet, the appropriate no-passing marking (one direction or two direction) should connect the zones.



Note: No-passing zones in opposite directions may or may not overlap, depending on alignment.



Note: No-passing zones in opposite directions may or may not overlap, depending on alignment.

Figure 3-7. Method of locating and determining the limits of no-passing zones at vertical and horizontal curves.

The no-passing marking is also used on two-way roadways at pavement width transitions (sec. 3B-8) and on approaches to obstructions which must be passed on the right (sec. 3B-13). It may also be used on approaches to railroad grade crossings and other locations where passing should be prohibited.

3B-5 Warrants for No-Passing Zones at Curves

OK
A no-passing zone at a horizontal or vertical curve is warranted where the sight distance, as defined below, is less than the minimum necessary for safe passing at the prevailing speed of traffic. Passing sight distance on a vertical curve is the distance at which an object 3.75 feet above the pavement surface can just be seen from a point 3.75 feet above the pavement (fig. 3-7a). Similarly passing sight distance on a horizontal curve is the distance measured along the center line (or right hand lane line of a three-lane highway) between two points 3.75 feet above the pavement on a line tangent to the embankment or other obstruction that cuts off the view on the inside of the curve (fig. 3-7b). Where center lines are installed and a curve warrants a no-passing zone, it should be so marked where the sight distance is equal to or less than that listed below for the prevailing off-peak 85 percentile speed:

85 Percentile Speed (MPH)	Minimum Passing Sight Distance (Feet)
30	500
40	600
50	800
60	1000
70	1200

Table changed

The beginning of a no-passing zone (point "a," fig. 3-7) is that point at which the sight distance first becomes less than that specified in the above table. The end of the zone (point "b") is that point at which the sight distance again becomes greater than the minimum specified.

3B-6 Pavement Edge Lines

Pavement edge line markings provide an edge of pavement guide for drivers. They have a unique value as a visual reference for the guidance of drivers during adverse weather and visibility conditions. They also may be used where edge delineation is desirable to reduce driving on paved shoulders or refuge areas of lesser structural strength than adjacent pavement. Edge lines should not be continued through intersections and should not be broken for driveways.

Edge lines shall be provided on all Interstate highways and may be used on other classes of roads. The lines shall be white except that on divided highways where medians are extremely narrow or where obstructions exist to restrict the area beyond the edge line from use as an emergency refuge, the markings adjacent to the median should be yellow.

See
Vol VII
SIP 216
p 36

also Vol IV
p 87
p 89

3B-7 Pavement Marking Extensions Through Intersections or Interchanges

Where road design or reduced visibility conditions make it desirable to provide control or to guide vehicles through an interchange or intersection, (such as at offset, skewed, complex multi-legged intersections or where multiple turn lanes are used) a dotted line may be used to extend markings as necessary through the interchange or intersection area (figs. 3-8a, 3-10). Where a greater degree of restriction is required, solid lane lines or channelizing lines may be continued through intersections. A frequent use for the channelizing line is to separate turning movements (figs. 3-8b, 3-8c).

3B-8 Lane Reduction Transitions

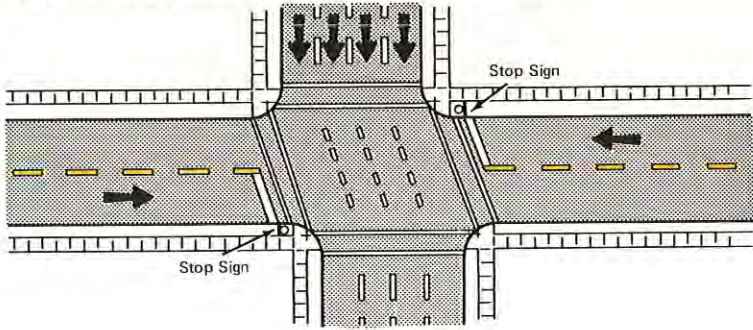
Where pavement markings are used, lane reduction markings shall be used to guide traffic at points where the pavement width changes to a lesser number of through lanes. No-passing markings shall be used to prohibit passing in the direction of the convergence, throughout the transition area. Converging lines should have a length of not less than that determined by the formula $L = S \times W$, where L equals the length in feet, S the off-peak 85 percentile speed in miles per hour, and W the offset distance in feet. On new construction, where no 85 percentile speed is established, the design speed may be used.

A number of situations are possible, as illustrated in figure 3-9, depending on which lanes must be offset or terminated and the amount of offset. One or more lane lines must be discontinued, and the remaining center and lane lines must be connected in such a way as to merge traffic into the reduced number of lanes.

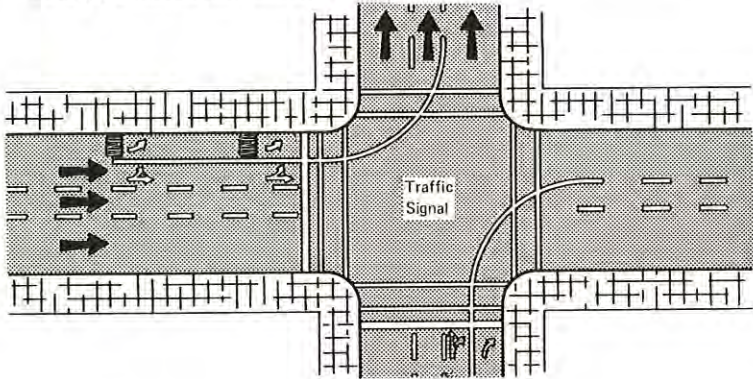
Lane lines should be discontinued one-quarter of the distance between the Pavement Width Transition sign (sec. 2C-18) and the point of convergence. Edge lines should be installed from the location of the warning sign, past the beginning of the narrower roadway (fig. 3-9).

Pavement markings at pavement-width transitions supplement the standard signs.

a—Typical pavement marking with offset lane lines continued through the intersection and optional crosswalk lines and stop limit lines.



b—Typical pavement marking with optional double turn lane lines, pavement messages, crosswalk lines, and stop limit lines.



c—Typical pavement marking with optional turn lane lines, crosswalk lines, and stop limit lines.

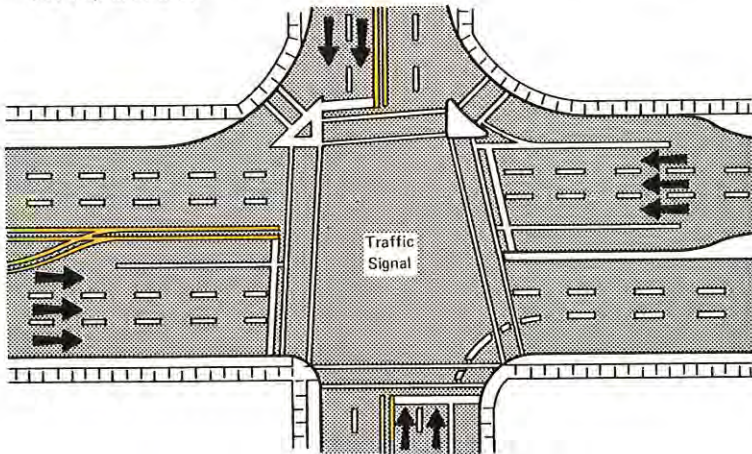
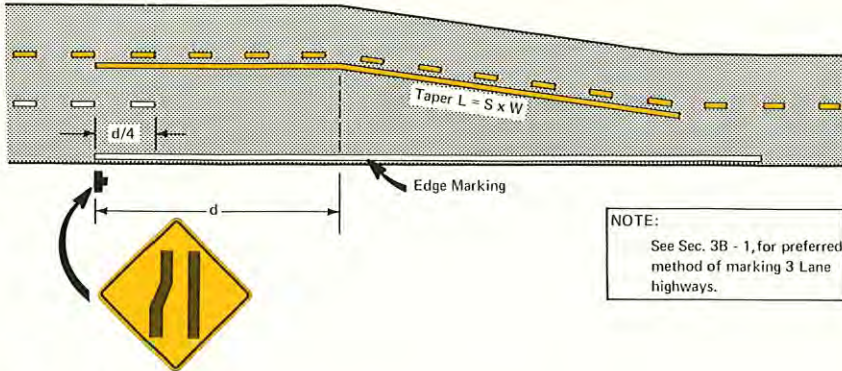
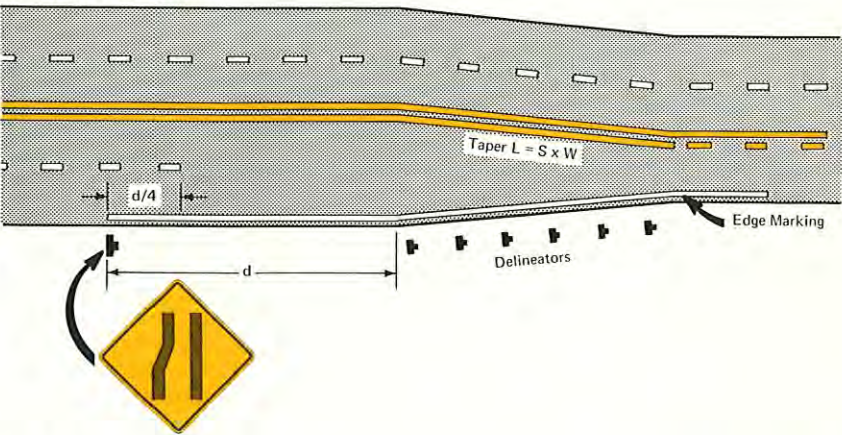


Figure 3-8. Typical pavement marking applications.

a - From 3 lanes to 2 lanes



b - From 4 lanes to 3 lanes



c - From 4 lanes to 2 lanes

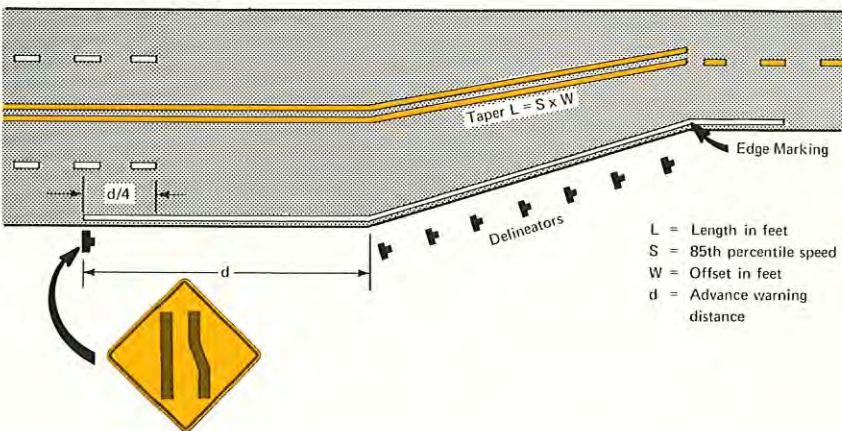


Figure 3-9. Typical pavement-width transition markings and signs.

3B-9 Channelizing Line

The channelizing line shall be a wide or double solid white line.

The channelizing line may be used to form traffic islands where travel in the same direction is permitted on both sides. Other markings in the island area such as crosshatching shall be white.

Typical examples of channelizing line applications are shown in figures 3-3, 3-4, 3-5, 3-8, 3-12.

3B-10 Median Islands Formed by Pavement Markings

Two double yellow lines shall be used to form continuous median islands where these islands separate travel in opposite directions. Other markings in the median island area such as crosshatching shall be yellow (sec. 3A-8).

3B-11 Marking of Interchange Ramps

Channelizing lines at exit ramps of expressways provide a neutral area which reduces the probability of collision with the curb nose and also directs exiting traffic at the proper angle for smooth divergence into the ramp. The channelizing line promotes safe and efficient merging with the through traffic at entrance ramps (fig. 3-11).

For exit ramps, channelizing lines should be placed along both sides of the neutral area between the main roadway and the exit ramp lane. With a parallel deceleration lane, a lane line should be extended from the beginning of the channelizing line for a distance of approximately one-half the length of the full width deceleration lane. White markings may be placed in the neutral area for special emphasis.

For entrance ramps, a channelizing line should be placed along the side of the neutral area adjacent to the ramp lane. With a parallel acceleration lane, a lane line should be extended from the end of the channelizing line for a distance approximately one-half the length of the full width acceleration lane. With a tapered acceleration lane, a lane line may be placed to extend the channelizing line, but not beyond a point where the tapered lane meets the near side of the through traffic lane (fig. 3-11).

3B-12 Combination Lane and Center Line Markings for Unique Applications

It is sometimes necessary to use markings in certain combinations not previously described for special applications intended to improve traffic operations.

For reversible lane markings, each edge of the lane shall be marked by the use of a normal broken double yellow line with the

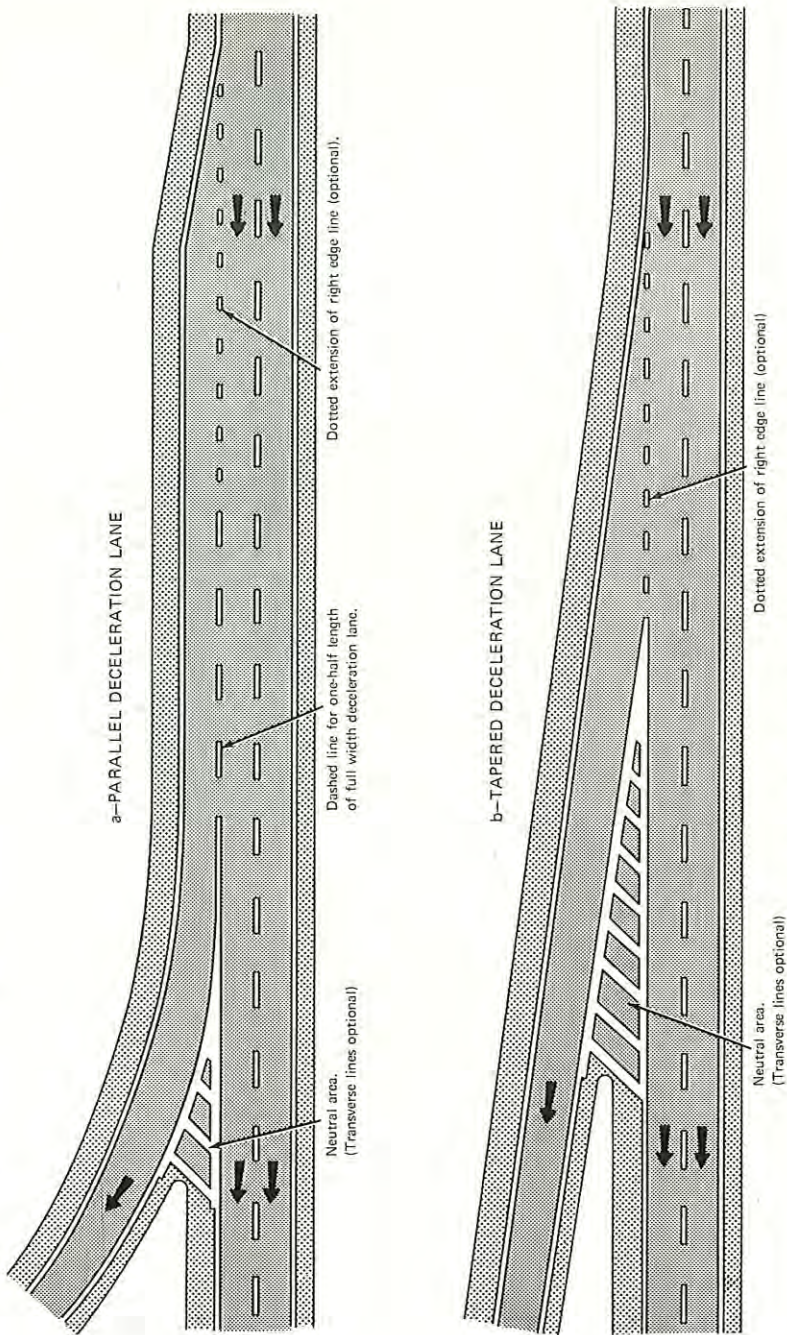


Figure 3-10. Typical exit ramp markings.

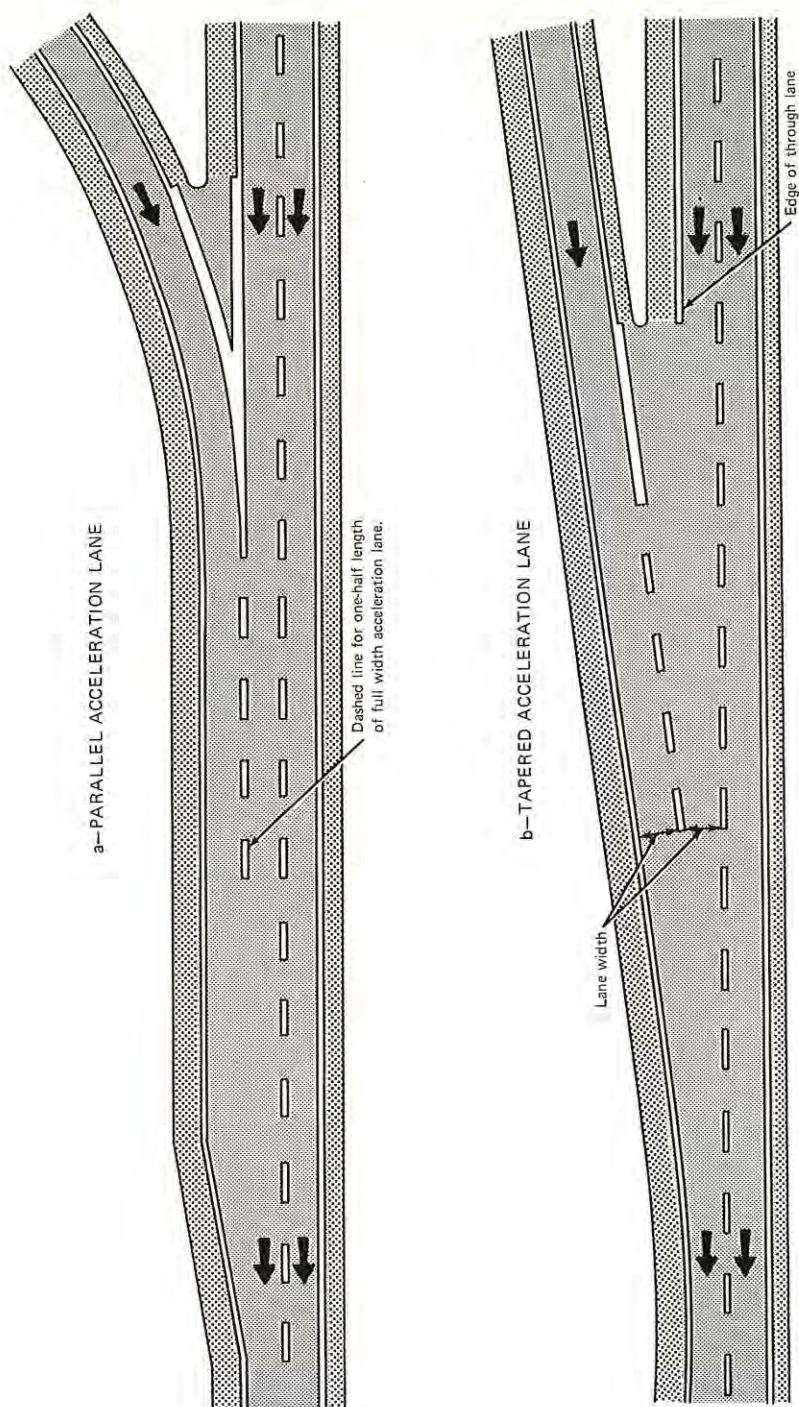
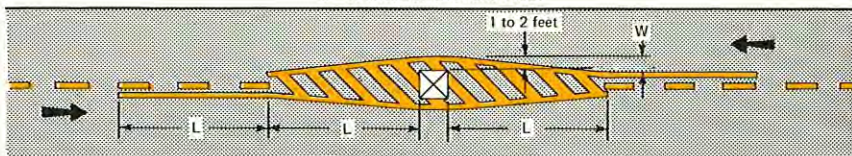


Figure 3-11. Typical entrance ramp markings.

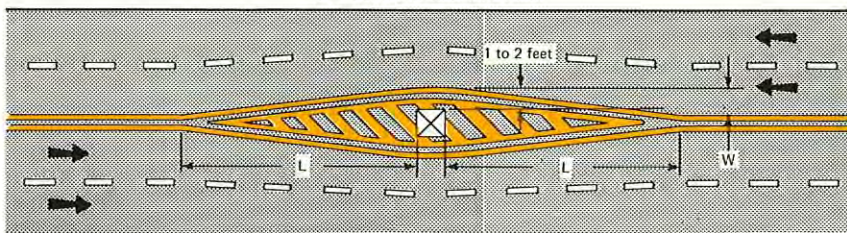
gaps and segments adjacent to one another. Signs and/or signals shall be used to supplement the pavement markings (fig. 3-1a).

A two-way left turn lane is a lane reserved in the center of a highway for exclusive use of left turn vehicles and shall not be used for

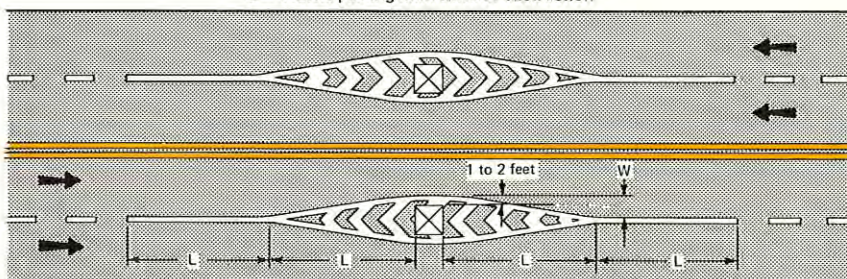
a — Center of two-lane road.



b — Center of four-lane road.



c — Traffic passing both sides of obstruction



$$L = S \times W$$

S = 85th percentile speed in miles per hour

W = Offset distance in feet

Minimum length of: L = 100 feet in urban areas

L = 200 feet in rural areas

Length "L" should be extended as required by sight distance conditions.

Figure 3-12. Typical approach markings for obstructions in the roadway.

passing and overtaking or travel by a driver except to make a left turn. The lane may be used by drivers making the left turn in either direction. A two-way left turn lane shall be marked as shown in figure 3-4a by a single direction, no-passing marking on each edge of the lane. This is generally used on a five lane highway where there are two lanes of through traffic in each direction. Signs should be used with the pavement markings (sec. 2B-17).

3B-13 Approach to an Obstruction

Pavement markings shall be used to guide traffic on the approach to fixed obstructions within a paved roadway. An obstruction may be so located that all traffic must keep to the right of it, or it may be between two lanes of traffic moving in the same direction. The markings in either case must be designed to guide traffic away from the obstruction. The use of channelizing lines or no-passing markings are generally effective. Obstruction approach markings for bridge supports, refuge islands, median islands, and channelization islands shall consist of a diagonal line, or lines, extending from the center line of lane line to a point 1 to 2 feet to the right side, or to both sides, of the approach end of the obstruction (fig. 3-12).

The length of the diagonal markings should be determined by the formula $L = S \times W$ where L equals the length in feet, S the off-peak 85 percentile speed in miles per hour, and W the width of the offset in feet. The minimum length of the diagonal shall be 100 feet in urban areas and 200 feet in rural areas.

If traffic is required to pass only to the right of the obstruction, the marking shall consist of a no-passing marking at least twice the length of the diagonal portion determined by the formula above.

A painted median island may be installed in advance of the obstruction by placing yellow markings in the triangular area between the markings.

If traffic may pass either to right or left of the obstruction, the markings shall consist of two channelizing lines diverging from the lane line, one to either side of the obstruction for a length determined by a formula $L = S \times W$. In advance of the point of divergence, a wide, solid white line or double white line shall be extended in place of the broken lane line for a distance equal to the length of the diverging lines.

It may be desirable where traffic is permitted to pass to both right and left of an obstruction, to place additional white markings in the triangular area between the markings as shown in figures 3-10 and 3-12.

3B-14 Stop Lines

Stop lines are solid white lines, normally 12 to 24 inches wide, extending across all approach lanes.

Stop lines should be used in both rural and urban areas where it is important to indicate the point, behind which vehicles are required to stop, in compliance with a STOP sign, traffic signal, officers' direction, or other legal requirement.

Stop lines, where used, should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line. In the absence of a marked crosswalk, the Stop line should be placed at the desired stopping point, in no case more than 30 feet or less than 4 feet from the nearest edge of the intersecting roadway.

If a stop line is used in conjunction with a STOP sign, it should ordinarily be placed in line with the STOP sign. However, if the sign cannot be located exactly where vehicles are expected to stop, the Stop line should be placed at the stopping point.

3B-15 Crosswalks and Crosswalk Lines

Crosswalk markings at signalized intersections and across intersectional approaches on which traffic stops, serve primarily to guide pedestrians in the proper paths. Crosswalk markings across roadways on which traffic is not controlled by traffic signals or STOP signs, must also serve to warn the motorist of a pedestrian crossing point. At non-intersectional locations, these markings legally establish the crosswalk.

Crosswalk lines shall be solid white lines, marking both edges of the crosswalk. They shall be not less than 6 inches in width and should not be spaced less than 6 feet apart. Under special circumstances where no advance stop line is provided or where vehicular speeds exceed 35 MPH or where crosswalks are unexpected, it may be desirable to increase the width of the crosswalk line up to 24" in width. Crosswalk lines on both sides of the crosswalk should extend across the full width of pavement to discourage diagonal walking between crosswalks (fig. 3-13a).

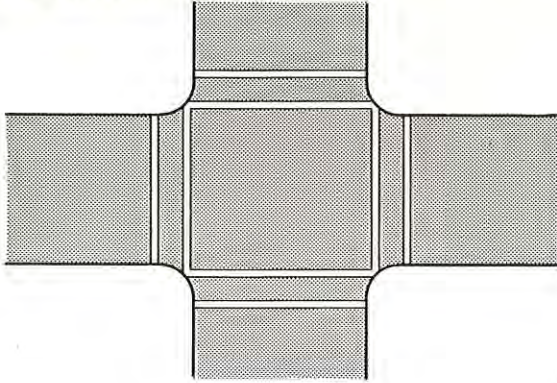
Crosswalks should be marked at all intersections where there is substantial conflict between vehicle and pedestrian movements. Marked crosswalks should also be provided at other appropriate points of pedestrian concentration, such as at loading islands, mid-block pedestrian crossing, and/or where pedestrians could not otherwise recognize the proper place to cross.

Crosswalk markings should not be used indiscriminately. A careful engineering study should be required before they are installed at locations away from traffic signals or STOP signs.

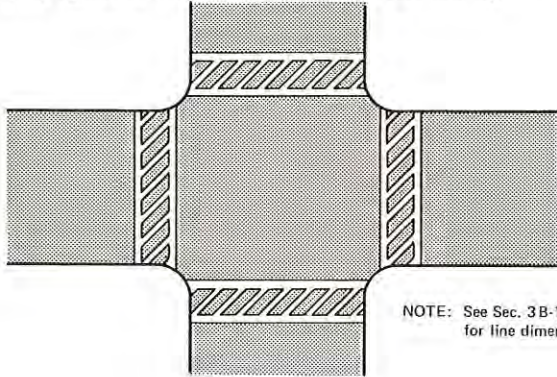
Since non-intersectional pedestrian crossings are generally unexpected by the motorist, warning signs (sec. 2C) should be installed and adequate visibility provided by parking prohibitions.

For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45° angle or with white longitudinal

a — Standard crosswalk marking.



b — Crosswalk marking with diagonal lines for added visibility.



NOTE: See Sec. 3B-15
for line dimensions

c — Crosswalk marking with longitudinal lines for added visibility.

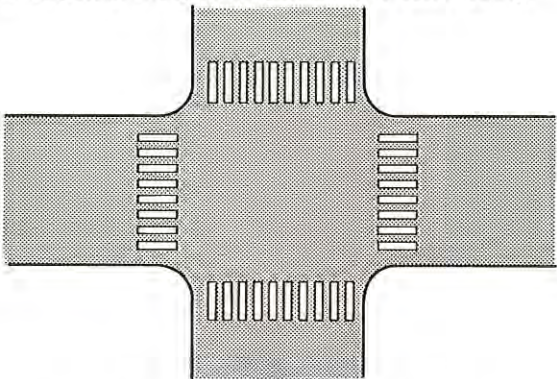
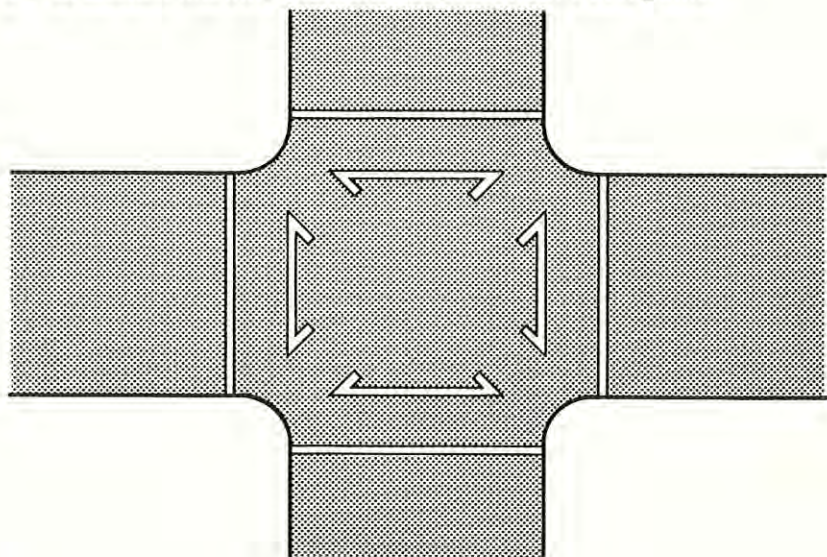


Figure 3-13. Typical crosswalk markings.

a — Crosswalk marking that outlines pedestrian travel paths.



b — Crosswalk marking that outlines the edge of pedestrian travel area.

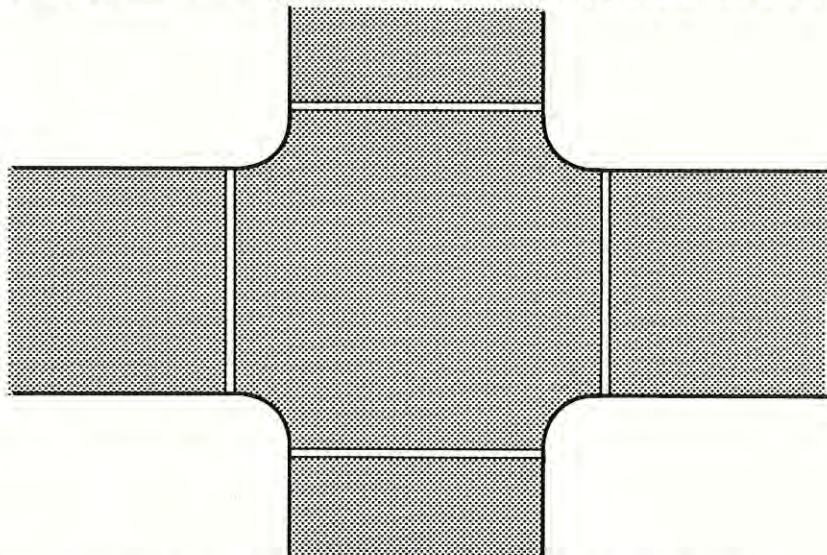


Figure 3-14. Typical crosswalk marking for exclusive pedestrian phase.

lines at a 90° angle to the line of the crosswalk (figs. 3-13b, 13c). These lines should be approximately 12'' to 24'' wide and spaced 12'' to 24'' apart. When diagonal or longitudinal lines are used to mark a crosswalk, the transverse crosswalk lines may be omitted. This type of marking is intended for use at locations where substantial numbers of pedestrians cross without any other traffic control device, at locations where physical conditions are such that added visibility of the crosswalk is desired or at places where a pedestrian crosswalk might not be expected. Care should be taken to insure that crosswalks with diagonal or longitudinal lines used at some locations do not weaken or detract from other crosswalks (where special emphasis markings are not used) (fig. 3-13a). When an exclusive pedestrian phase signal, which permits diagonal crossing, is installed at an intersection, a unique marking may be used for the crosswalk (fig. 3-14).

3B-16 Approach to Railroad Crossing

Pavement markings in advance of a railroad crossing shall consist of an X; the letters, RR; a no-passing marking and certain transverse lines. They should be placed on all paved approaches to railroad crossings. These markings, if physically feasible, shall be placed at all grade crossings where railroad highway grade crossing signals or automatic gates are operating, and at all other crossings where the prevailing speed of highway traffic is 40 MPH or greater.

The markings shall also be placed at crossings where engineering studies indicate there is a significant potential conflict between vehicles and trains. At minor crossings or in urban areas, these markings may be omitted if engineering study indicates that other devices installed provide suitable protection. Such markings shall be white except for the no-passing markings.

The design of railroad crossing pavement markings shall be essentially as illustrated in figure 3-15. The symbols and letters are elongated to allow for the low angle at which they are viewed.

3B-17 Parking Space Markings

Parking space markings shall be white.

The marking of parking space limits on urban streets encourages more orderly and efficient use of parking spaces where parking turnover is substantial and tends to prevent encroachment on fire hydrant zones, bus stops, loading zones, approaches to corners, clearance spaces for islands and other zones where parking is prohibited. Typical parking space markings are shown in figure 3-16.

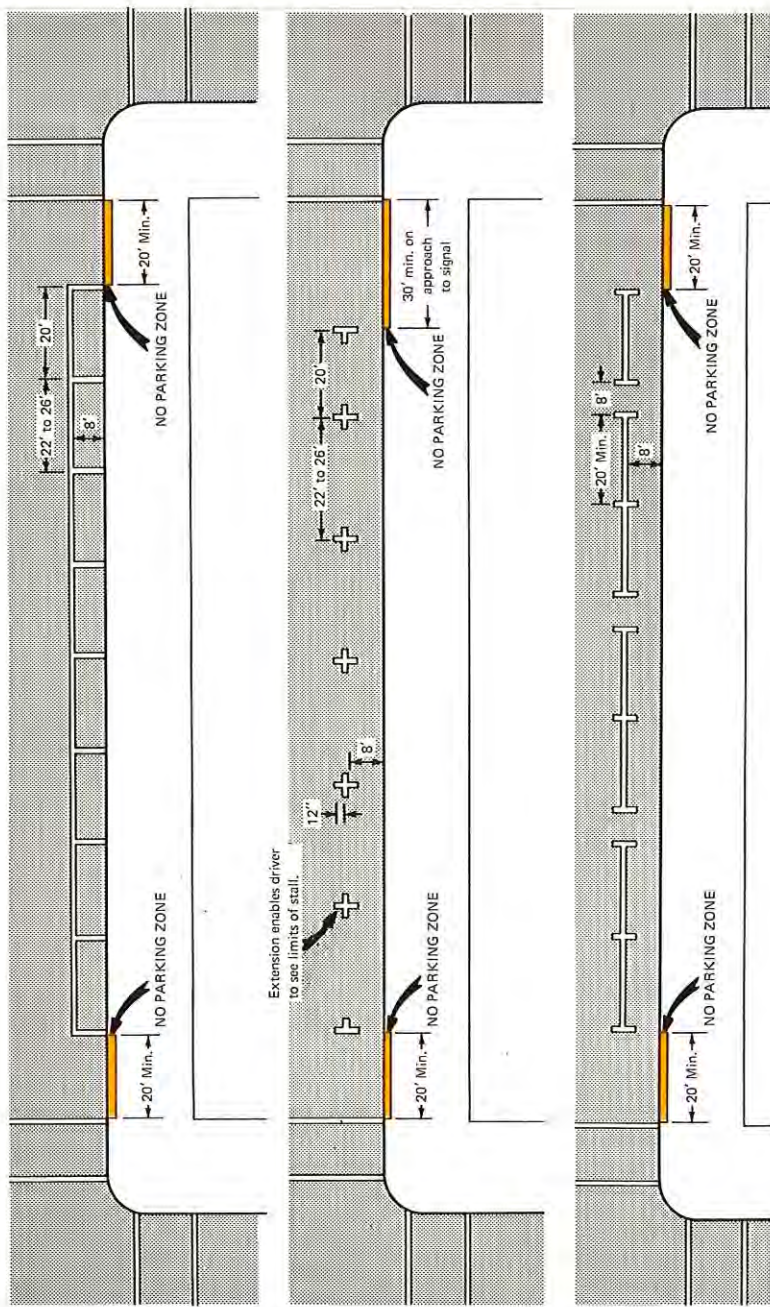


Figure 3-16. Typical parking-space-limit markings.

3B-18 Pavement Word and Symbol Markings

Word and symbol markings on the pavement may be used for the purpose of guiding, warning, or regulating traffic. They should be limited to not more than a total of three lines of words and/or symbols. They shall be white in color.

Word and symbol markings should not be used for mandatory messages except in support of standard signs. Symbol arrows indicating a single mandatory movement shall include the word "ONLY." Signs or markings should be repeated in advance of mandatory turn lanes when necessary to prevent entrapment and to help motorists select the appropriate lane before reaching the end of the line of waiting vehicles.

Symbol messages are generally preferable to word messages. The letters and symbols should be greatly elongated in the direction of traffic movement because of the low angle at which they are viewed by approaching drivers. Large letters, symbols and numerals should be used, 8 feet or more in height; and, if the message consists of more than one word, it should read "up," i.e., the first word should be nearest to the driver.

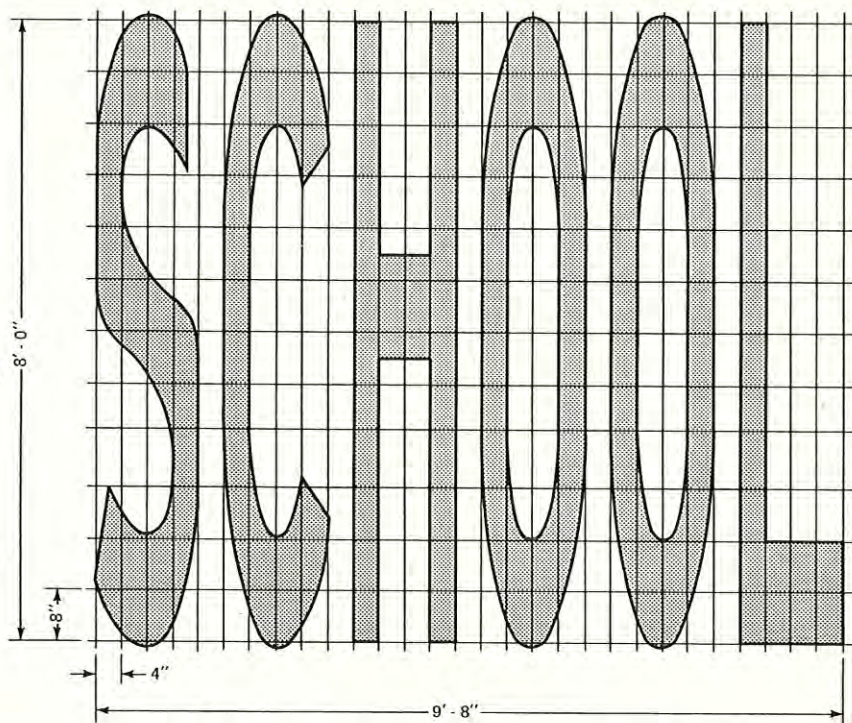


Figure 3-17. Elongated letters for pavement marking.

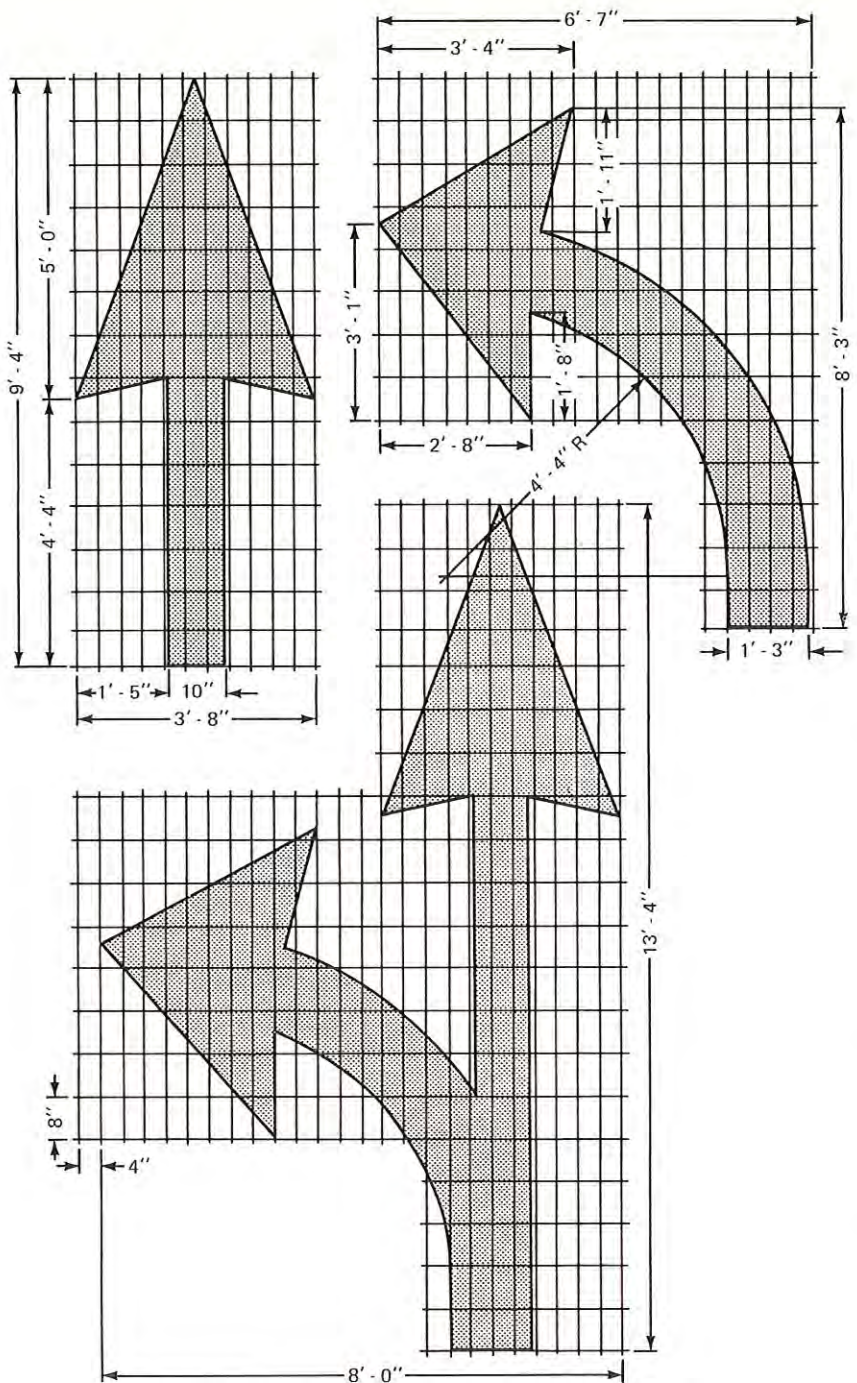


Figure 3-18. Elongated arrows for pavement markings.

Where speeds are low, somewhat smaller characters may be used. The space between lines should be at least four times the height of the characters for low speed roads but not more than ten times the height of the characters, under any conditions. Typical layouts are shown in figures 3-17 and 3-18.

Word and symbol markings considered appropriate for use when warranted include the following:

1. Regulatory:

"STOP"

"RIGHT (LEFT) TURN ONLY"

"25MPH"

"SYMBOL ARROWS"

(Note: Symbol arrows shall be supplemented by word "ONLY," if mandatory.)

2. Warning:

"STOP AHEAD"

"SIGNAL AHEAD"

"SCHOOL"

"SCHOOL X-ING"

"PED X-ING"

"R X R"

(Railroad Crossing)

(secs. 2B-42, 2C-31)

3. Guide:

"US 40"

"ROUTE 40"

"STATE 135" (Other words or symbols may be necessary under certain conditions.)

Since an uncontrolled use of pavement markings can result in driver confusion the number of different word and symbol markings should be minimized.

The word "STOP" shall not be used on the pavement unless accompanied by a stop line (sec. 3B-14) and STOP sign (sec. 2B-4).

The word STOP shall not be placed on the pavement in advance of a stop line, unless every vehicle is required to stop at all times.

Pavement messages should generally be no more than one lane in width except the "SCHOOL" messages (sec. 7C-6).

Figure 3-19 shows the use of word and symbol markings on the pavement.

3B-19 Curb Markings for Parking Restrictions

Since curb markings of yellow and white are used for delineation and visibility, it is usually advisable to establish parking regulations through the installation of standard signs (secs. 2B-29 to 31). However, when local authorities prescribe special colors for curb markings as supplemental to standard signs, they may be used.

When signs are not used, intended meaning should be stenciled on the curb.

Signs shall always be used with curb markings in those areas where curb markings are frequently obliterated by accumulations of snow and ice.

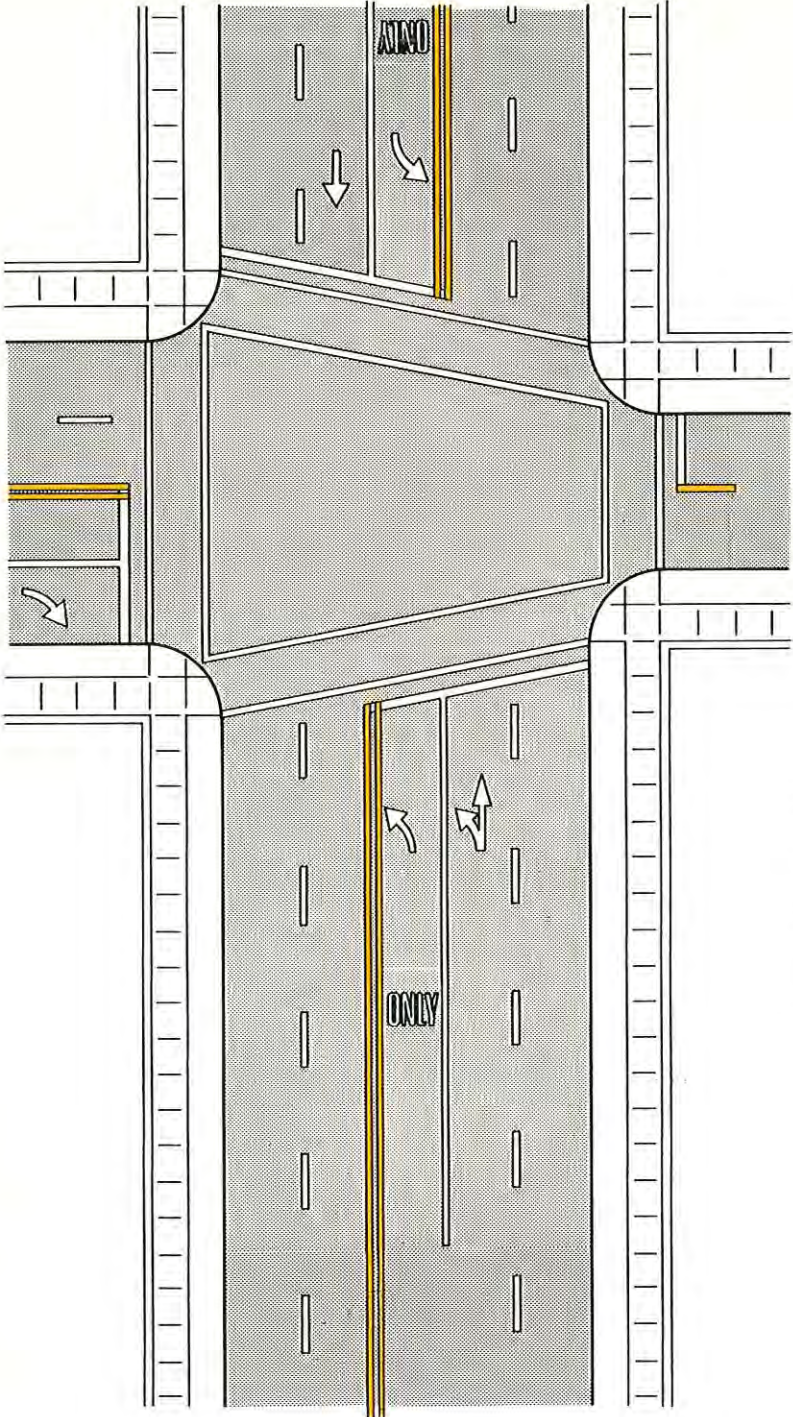


Figure 3-19. Typical lane-use-control word and symbol markings.

C. OBJECT MARKINGS**3C-1 Object Marker Design**

When obstructions within or adjacent to the roadway require marking, the marker shall consist of an arrangement of one or more of the following designs:

Type 1—Either a marker consisting of nine yellow reflectors, each with a minimum dimension of approximately 3", mounted symmetrically on an 18" yellow or black diamond panel; or an all yellow reflective diamond panel of the same size. Type 1 markers may be larger if conditions warrant.

Type 2—Either a marker consisting of three yellow reflectors, each with a minimum dimension of approximately 3", arranged either horizontally or vertically; or an all yellow reflective panel, 6" x 12". Type 2 markers may be larger if conditions warrant.

Type 3—Striped marker consisting of a vertical rectangle approximately 1 foot by 3 feet in size with alternating black and reflectorized yellow or white stripes sloping downward at an angle of 45° toward the side of the obstruction on which traffic is to pass. The minimum width of the yellow or white stripe shall be 3 inches. A better appearance can be achieved if the black stripes are wider than the yellow or white stripes.

3C-2 Objects in the Roadway

Obstructions within the roadway, shall be marked with a Type 1 or Type 3 object marker.

For additional emphasis a large surface such as a bridge pier may be painted with diagonal stripes, 12 inches or greater in width, similar in design to the Type 3 object marker. The alternating black and reflectorized yellow or white stripes shall be sloped down at an angle of 45° toward the side of the obstruction which traffic is to pass. Where a sign is used with the diagonal stripes, the stripe markings should be discontinued to leave a 3-inch space around the outside of the sign.

Appropriate signs (secs. 2B-24, 2C-34) directing traffic to one or both sides of the obstruction may be used in lieu of the object marker. In addition to markings on the face of an obstruction in the roadway, warning of approach to the obstruction shall be given by appropriate pavement markings (sec. 3B-13).

Where the vertical clearance of an overhead structure exceeds the maximum legal height of vehicle by less than one foot the clearance in feet and inches should be clearly marked on the structure (sec. 2C-35).

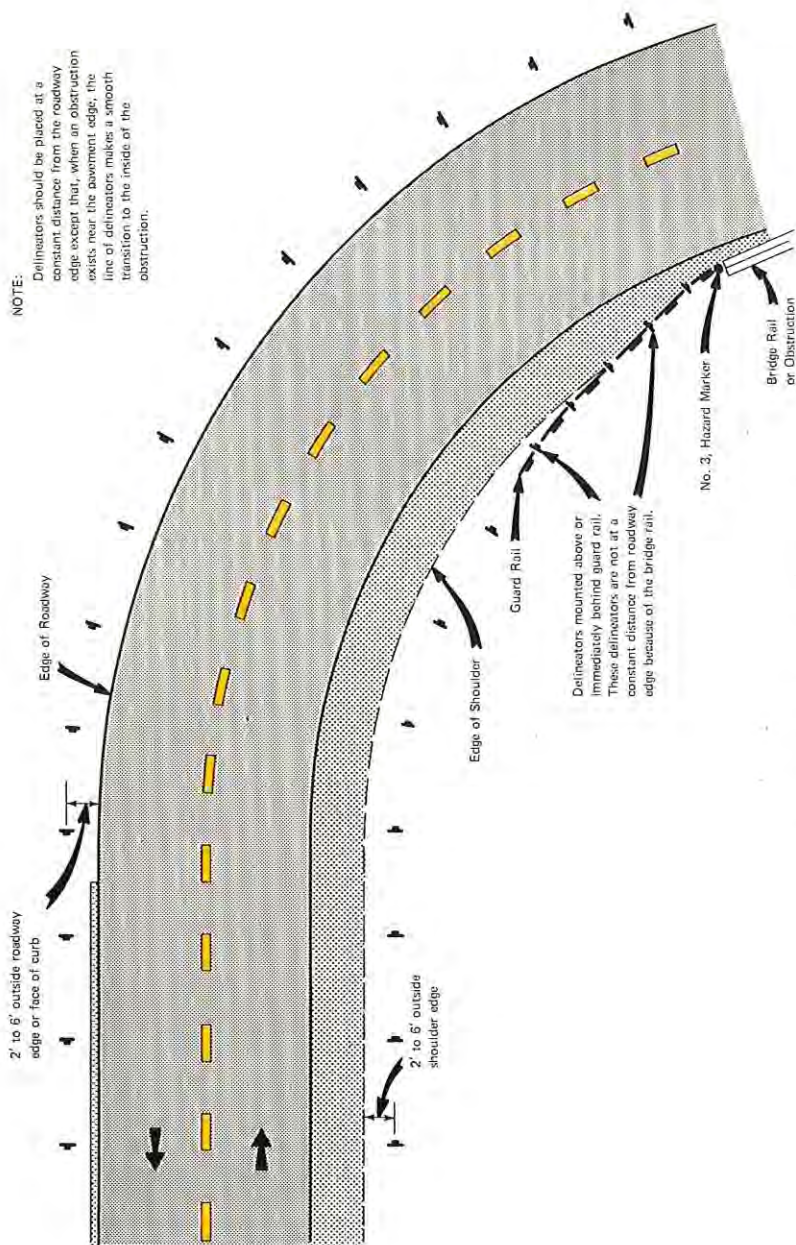


Figure 3-20. Typical delineator installation.

3C-3 Objects Adjacent to the Roadway

Objects not actually in the roadway may be so close to the edge of the road that they need a marker. These include underpass piers, bridge abutments, handrails and culvert headwalls. In some cases there may not be a physical object involved, but other roadside conditions such as narrow shoulder drop-offs, gores, small islands and abrupt changes in roadway alignment may make it undesirable for a driver to leave the roadway. Type 2 or 3 object markers are intended for use at such locations. The inside edge of the marker shall be in line with the inner edge of the obstruction.

Standard warning signs (sec. 2C) should also be used where applicable. Typical applications of markers for roadside obstructions are shown in figure 3-20.

3C-4 End of Roadway

The marker for the end of a roadway, at which point there is no alternate vehicular path, shall be either a marker consisting of nine red reflectors, each with a minimum dimension of approximately 3", mounted symmetrically on an 18 inch square, red or black panel; or an 18 inch square reflectorized red-panel. More than one marker or a larger marker may be used at the end of the roadway where conditions warrant. The minimum mounting height of this marker shall be four feet. Appropriate advance warning signs should be used.

D. DELINEATION

3D-1 Delineators

Road delineation markers are effective aids for night driving and are to be considered as guide markings rather than warning devices. Delineators may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment, particularly where the alignment might be confusing, or at pavement width transitions. An important advantage of delineators, in certain areas, is that they remain visible when the roadway is wet or snow-covered.

3D-2 Design

Delineators shall consist of reflector units capable of clearly reflecting light under normal atmospheric conditions from a distance of 1,000 feet when illuminated by the upper beam of standard automobile lights. Reflective elements for delineators shall have a minimum dimension of approximately 3 inches. Elongated reflective

units of appropriate size may be used in place of two reflectors mounted as a unit.

3D-3 Curb Markings for Delineation

Reflectorized solid yellow should be placed on the curbs of islands located in the line of traffic flow where the curb serves to channel traffic to the right of the obstruction. Reflectorized solid white should be used when traffic may pass on either side of the island.

Where the curbs of the islands become parallel to the direction of traffic flow it is not necessary to mark the curbs unless a study indicates the need for this type of delineation. Where these curbs are marked, the colors shall conform to the general principles of markings (sec. 3A-5).

Curbs at openings in a continuous median island need not be marked unless individual study indicates the need for this type of marking.

3D-4 Delineator Application

Delineators used on through two-lane, two-way roadways shall be single white reflector units on the right side. Single white reflector units may be placed on the left side of the two-way roadways particularly at sharp right-hand curves.

On through roadways of expressway type facilities, single white delineators shall be placed on the right side. If used on the left side for additional guidance, they shall be white also. Where median crossovers are provided for official or emergency use on freeways and where these crossovers are to be marked, a double yellow delineator should be placed on the left side of the through roadway on the far side of the crossover for each roadway.

Double or vertically elongated yellow delineators shall be spaced at 100 foot intervals along acceleration and deceleration lanes and along the outside or both sides of tangent portions of interchange ramps. Where delineators are used only on one side of an interchange ramp, and the ramp is curved, the delineators shall be placed on the outside of the curve, with appropriate spacing as set forth in table III-1. On curved ramps, where the curves reverse direction, delineators should be used on the outside of each curve and should overlap in the area of the direction change.

Red delineators may be used on the reverse side of any delineator whenever it would be viewed by a motorist traveling in the wrong direction on that particular ramp or roadway.

Delineators of the appropriate color (white for through roadways and yellow for interchange ramps) may be used to indicate the narrowing of the pavement where either an outside or inside lane merges into an adjacent lane. The delineators should be used adjacent to the lane affected for the full length of the convergence

and should be so placed and spaced to show the width reduction (fig. 3-9). Delineation is not necessary for the traffic moving in the direction of a wider pavement or on the side of the roadway where the alignment is not affected by the convergence. On a highway with continuous delineation on either or both sides, delineators should be carried through the transition and a closer spacing may be warranted.

Delineation shall be optional on sections of roadway between interchanges where fixed-source lighting is in operation.

3D-5 Delineator Placement and Spacing

Delineators, if used, shall be mounted on suitable supports so that the top of the reflecting head is about 4 feet above the near roadway edge. They shall be placed not less than 2 or more than 6 feet outside the outer edge of the shoulder, or if appropriate, in the line of the guardrail.

Delineators should be placed at a constant distance from the edge of the roadway except that, where a guardrail or other obstruction intrudes into the space between the pavement edge and the extension of the line of delineators, the delineators should be in line with or inside the innermost edge of the obstruction. Typical delineator installations are shown in figure 3-20.

Normally, delineators should be spaced 200 to 528 feet. When normal uniform spacing is interrupted by driveways, cross roads, etc., delineators falling within such areas may be moved in either direction, a distance not exceeding one-quarter of the normal spacing. Delineators still falling within such areas should be eliminated.

Spacing should be adjusted on approaches and throughout horizontal curves so that several delineators are always visible to the driver. Table III-1 shows suggested maximum spacing for delineators at horizontal curves. (See next page)

E. COLORED PAVEMENTS

3E-1 Colored Pavements

When used for guidance and regulation of traffic, colored pavement surfaces are traffic control devices. Situations occur where colored pavements could supplement other traffic control devices. They should be used only where they contrast significantly with adjoining paved areas. Where colored pavements are used, the guidance or control provided shall be applicable at all times.

3E-2 Colors

The use of the following colors for pavements shall be limited to the purposes noted:

1. Red shall be used only on the approaches to a STOP sign which is in use 24 hours a day. The length of colored surface should be

related to the 85-percentile approach speed of traffic and give the driver a two to four second advance warning.

2. Yellow shall be used only for medians separating traffic flows in opposite directions.

3. White shall be used for delineation on shoulders, on channelizing islands where traffic flows pass on both sides in the same general direction, and for crosswalks.

TABLE III-1 Suggested Maximum Spacing for Highway Delineators On Horizontal Curves

Radius of Curve (in feet)	Spacing On Curve (in feet)	(Distance in Feet Rounded to the Nearest 5 Feet) Spacing in Advance & Beyond Curve (in feet)		
		1st	2nd	3rd
50	20	40	65	125
150	30	60	90	180
200	35	70	110	215
250	40	85	125	250
300	50	95	145	290
400	55	110	170	300
500	65	125	190	300
600	70	140	210	300
700	75	150	230	300
800	80	165	245	300
900	85	175	260	300
1,000	90	185	275	300

Spacing for specific radii not shown may be interpolated from table or computed from the formula $S=3\sqrt{R-50}$. The minimum spacing should be 20 feet. The spacing on curves should not exceed 300 feet. The spacing of the first delineator approaching a curve is 2 S, the second 3 S, and the third 6 S but not to exceed 300 feet. If a spacing less than 300 feet is used approaching the curve, the distance shown above should be adjusted accordingly.

Part IV. SIGNALS

A. GENERAL

4A-1 Types

This part of the Manual relates to a group of devices called highway traffic signals. These devices include: traffic control signals, beacons, lane-use control signals, drawbridge signals, emergency traffic control signals and train approach signals and gates.

4A-2 Basis of Installation

In most cases the installation of a highway traffic control signal will operate either to the advantage or disadvantage of the vehicles and persons controlled. A careful analysis of traffic operations and other factors at a large number of signalized and unsignalized intersections, coupled with the judgment of experienced engineers, have provided a series of warrants that define the minimum conditions under which signal installations may be justified. Consequently the selection and use of this control device should be preceded by a thorough engineering study of roadway and traffic conditions.

Engineering studies should be made of operating signals to determine if the type of installation and the timing program meet the current requirements of traffic.

B. TRAFFIC CONTROL SIGNALS

4B-1 General Aspects

There are two types of traffic control signals, pretimed and traffic-actuated.

The features of traffic control signals in which vehicle operators and pedestrians are interested are the location, design, indications, and legal significance of the signals. These are identical for all types of traffic control signals. Uniformity in the design features that affect the traffic to be controlled (as set forth in this Manual) is especially important for safe and efficient traffic operations.

Special police supervision and/or enforcement should be provided for a new non-intersection location.

4B-2 Area of Control

A traffic control signal shall control traffic only at the intersection or mid-block location where the installation is placed.

4B-3 Advantages and Disadvantages of Traffic Control Signals

Traffic control signals are valuable devices for the control of vehicle and pedestrian traffic. However, because they assign the right-of-way to the various traffic movements, traffic control signals exert a profound influence on traffic flow.

Traffic control signals, properly located and operated usually have one or more of the following advantages:

1. They can provide for the orderly movement of traffic.
2. Where proper physical layouts and control measures are used, they can increase the traffic-handling capacity of the intersection.
3. They can reduce the frequency of certain types of accidents, especially the right-angle type.
4. Under favorable conditions, they can be coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route.
5. They can be used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Many laymen believe that traffic signals provide the solution to all traffic problems at intersections. This has led to their installation at a large number of locations where no legitimate factual warrant exists.

Traffic signal installations, even though warranted by traffic and roadway conditions, can be ill-designed, ineffectively placed, improperly operated, or poorly maintained. The following factors can result from improper or unwarranted signal installations:

1. Excessive delay may be caused.
2. Disobedience of the signal indications is encouraged.
3. The use of less adequate routes may be induced in an attempt to avoid such signals.
4. Accident frequency (especially the rear-end type) can be significantly increased.

4B-4 Portable Traffic Control Signals

A portable traffic control signal not meeting all the requirements of this Manual, is not recognized as a standard traffic control device.

4B-5 Meaning of Signal Indications

The following meanings shall be given to highway traffic signal indications, except those on pedestrian signals:

1. Green indications shall have the following meanings:¹
 - a. Traffic, except pedestrians, facing a CIRCULAR GREEN may proceed straight through or turn right or left unless a sign at such place prohibits either such turn. But vehicular traffic, includ-

¹ Section 11-202, Uniform Vehicle Code, Revised 1968.

ing vehicles turning right or left, shall yield the right-of-way to other vehicles, and to pedestrians lawfully within the intersection or an adjacent crosswalk, at the time such signal is exhibited.

b. Traffic, except pedestrians, facing a GREEN ARROW, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

c. Unless otherwise directed by a pedestrian signal, pedestrians facing any green indication, except when the sole green indication is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.

2. Steady yellow indications shall have the following meanings:²

a. Traffic, except pedestrians, facing a steady CIRCULAR YELLOW or YELLOW ARROW signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter when vehicular traffic shall not enter the intersection.

b. Pedestrians facing a steady CIRCULAR YELLOW or YELLOW ARROW signal, unless otherwise directed by a pedestrian signal, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.

3. Steady red indications shall have the following meanings:³

a. Traffic, except pedestrians, facing a steady CIRCULAR RED signal alone shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown except as provided in b below.

b. When a sign is in place permitting a turn, traffic, except pedestrians, facing a steady CIRCULAR RED signal may cautiously enter the intersection to make the turn indicated by such sign after stopping as provided in a above. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

c. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady CIRCULAR RED signal alone shall not enter the roadway.

² Ibid.

³ Ibid.

d. Traffic, except pedestrians, facing a steady RED ARROW indication may not enter the intersection to make the movement indicated by such arrow, and unless entering the intersection to make such other movement as is permitted by other indications shown at the same time, shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to make the movement indicated by such arrow is shown.

e. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady RED ARROW signal indication shall not enter the roadway.

4. Flashing signal indications shall have the following meanings:⁴

a. Flashing red (stop signal)—When a red lens is illuminated with rapid intermittent flashes, drivers of vehicles shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then at the point nearest the intersecting roadway where the driver has a view of approaching traffic on the intersecting roadway before entering the intersection, and the right to proceed shall be subject to the rules applicable after making a stop at a STOP sign.

b. Flashing yellow (caution signal)—When a yellow lens is illuminated with rapid intermittent flashes, drivers of vehicles may proceed through the intersection or past such signal only with caution.

4B-6 Application of Signal Indications

Basic displays used in signal operations are the steady CIRCULAR RED, CIRCULAR YELLOW or CIRCULAR GREEN indication, used on each of the approaches. The application for these signal indications shall be as follows:

1. A steady CIRCULAR RED indication:

a. Shall be given when it is intended to prohibit traffic from entering the intersection or other controlled area.

b. Should be displayed with the appropriate green arrow indications when it is intended to permit traffic to make a specified turn or turns, and to prohibit traffic from proceeding straight ahead through the controlled area. This display is optional where it is physically impossible for traffic to go straight ahead, as at the head of a "T" intersection.

c. Shall be given when it is intended to prohibit all traffic, except pedestrians directed by a pedestrian signal, from entering the intersection or other controlled area.

⁴ Section 11-204, op. cit.

2. A steady CIRCULAR YELLOW indication :

a. Shall be given following a CIRCULAR GREEN indication in the same signal face.

b. Is an optional alternative to a yellow arrow indication following a green arrow indication in a separate signal face used exclusively to control a single directional movement.

3. A steady CIRCULAR GREEN indication shall be given only when it is intended to permit traffic to proceed in any direction which is lawful and practical.

4. Steady RED ARROW, YELLOW ARROW and GREEN ARROW indications may be used in lieu of the corresponding circular indications at the following locations :

a. On an approach intersecting a one-way street.

b. Where certain movements are prohibited.

c. Where certain movements are physically impossible.

d. On an intersection approach which has an exclusive lane for turning movements.

e. Where turning movements are "protected" from conflicting movements by other indications or by the signal sequence.

f. Where all the movements on the approach do not begin or end at the same time and where the indications for the turning movements will also be visible to traffic with other allowable movements.

If steady arrow indications are used :

a. A steady RED ARROW indication shall be used only in a separate signal face which also contains steady YELLOW ARROW and GREEN ARROW indications. It shall be used for controlling only a single traffic movement.

b. A steady YELLOW ARROW indication shall be used following a GREEN ARROW indication (which has been displayed simultaneously with a CIRCULAR RED indication in the same signal face).

c. A steady YELLOW ARROW indication may be used (in a separate signal face) following a GREEN ARROW indication, when that face is used exclusively to control a single directional movement.

d. A steady YELLOW ARROW indication may be used to indicate the clearance interval following the termination of a GREEN ARROW indication (when displayed simultaneously with a continuing CIRCULAR GREEN indication in the same signal face).

e. A steady GREEN ARROW indication shall be used only when there would be no conflict with other vehicles or with pedestrians crossing in conformance with the WALK indication.

5. The following combinations of signal indications shall not be simultaneously displayed on any one signal face, and shall not be simultaneously displayed in different signal faces on any one approach to an intersection unless the signal faces are shielded, hooded, louvered, positioned or designed so that none of these prohibited combinations of signal indications is readily visible to drivers:

- a. CIRCULAR GREEN with CIRCULAR YELLOW.
- b. Straight-through GREEN ARROW with CIRCULAR RED.
- c. CIRCULAR RED with CIRCULAR YELLOW.
- d. CIRCULAR GREEN with CIRCULAR RED.
- e. CIRCULAR GREEN with RED ARROW.

6. When a traffic control signal is put on flashing operation, normally a yellow indication should be used for the major street and a red indication for the other approaches. Yellow indications shall not be used for all approaches. The following applications shall apply whenever signals are placed in flashing operation:

- a. A CIRCULAR YELLOW indication shall be flashed instead of any YELLOW ARROW indication which may be included in that signal face.
- b. No CIRCULAR GREEN or GREEN ARROW indication or flashing yellow indication shall be terminated and immediately followed by a steady red or flashing red indication without the display of the steady yellow change indication; however, transition may be made directly from a CIRCULAR GREEN or GREEN ARROW indication to a flashing yellow indication.

4B-7 Number of Lenses per Signal Face

Each signal face, except in pedestrian signals, shall have at least three lenses, but not more than five. The lenses shall be red, yellow or green in color, and shall give a circular or arrow type of indication. Allowable exceptions to the above are:

- 1. Where a single section green arrow lens is used alone to indicate a continuous movement.
- 2. As discussed under Unexpected Conflicts During Green Interval (sec. 4B-16).
- 3. Where one or more indications are repeated for reasons of safety or impact.

4B-8 Size and Design of Signal Lenses

The aspect of all signal lenses, except in pedestrian signals, shall be circular. There shall be two sizes for lenses, 8 inches and 12 inches nominal diameter.

Twelve-inch lenses normally should be used:

1. For intersections with 85 percentile approach speeds exceeding 40 mph.
2. For intersections where signalization might be unexpected.
3. For special problem locations, such as those with conflicting or competing background lighting.
4. For intersections where drivers may view both traffic control and lane-direction-control signs simultaneously.
5. For all arrow indications.

Arrows shall be pointed vertically upward to indicate a straight-through movement and in a horizontal direction to indicate a turn at approximately right angles. When the angle of the turn is substantially different from a right angle, the arrow should be positioned on an upward slope at an angle approximately equal to that of the turn.

Each arrow lens shall show only one arrow direction. The arrow shall be the only illuminated part of the lens visible.

In no case shall letters or numbers be displayed as part of a vehicular signal indication.

Except for the requirements of this section, all lenses shall conform to the Standard for Adjustable Face Vehicle Traffic Control Signal Heads, 1970 Edition.⁵

4B-9 Arrangement of Lenses in Signal Faces

The lenses in a signal face shall be arranged in a vertical or horizontal straight line, except that in a vertical array, lenses of the same color may be arranged horizontally adjacent to each other at right angles to the basic straight line arrangement (fig. 4-1). Such clusters shall be limited to two identical lenses or to two or three different lenses of the same color.

In each signal face, all red lenses in vertical signals shall be located above, and in horizontal signals shall be located to the left of all yellow and green lenses.

A CIRCULAR YELLOW lens shall be located between the red lens or lenses and all other lenses.

In vertically arranged signal faces, each YELLOW ARROW lens shall be located immediately above the GREEN ARROW lens to which it applies. In horizontally arranged signals, the YELLOW ARROW shall be located immediately to the left of the GREEN ARROW lens.

⁵ Available from the Institute of Traffic Engineers, Washington, D.C. 20006.

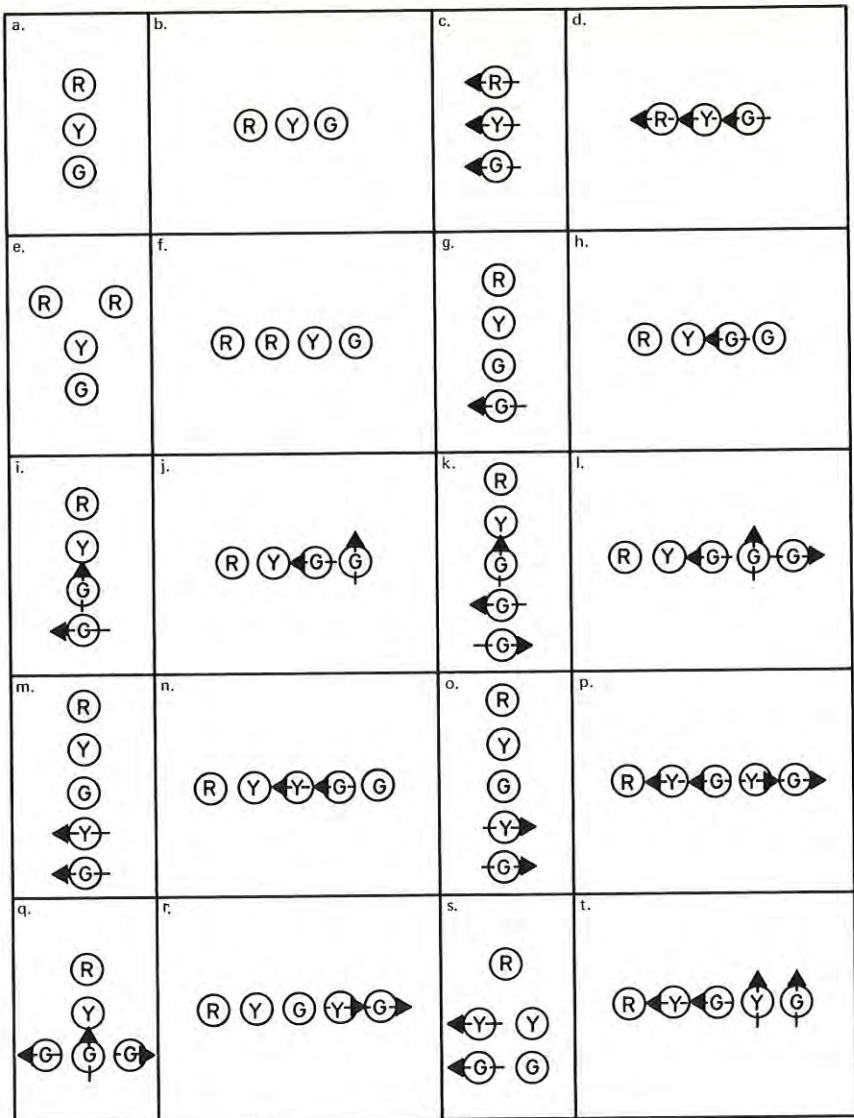


Figure 4-1. Typical arrangements of lenses in signal faces.

The relative positions of lenses within the signal face shall be as follows:

1. In a vertical signal face from top to bottom :
 CIRCULAR RED
 Left turn RED ARROW
 Right turn RED ARROW
 CIRCULAR YELLOW

Straight through YELLOW ARROW
 Straight through GREEN ARROW
 CIRCULAR GREEN
 Left turn YELLOW ARROW
 Left turn GREEN ARROW
 Right turn YELLOW ARROW
 Right turn GREEN ARROW

2. In a horizontal signal face from left to right:

CIRCULAR RED
 Left turn RED ARROW
 Right turn RED ARROW
 CIRCULAR YELLOW
 Left turn YELLOW ARROW
 Left turn GREEN ARROW
 CIRCULAR GREEN
 Straight through YELLOW ARROW
 Straight through GREEN ARROW
 Right turn YELLOW ARROW
 Right turn GREEN ARROW

3. In a cluster, identical signal indications may be repeated in adjacent vertical or horizontal locations within the same signal face. If adjacent indications in a cluster are not identical, their arrangement shall follow paragraph 1 or 2 above, as applicable.

Basic horizontal and vertical display faces may be used on the same approach provided they are separated to meet the lateral clearance required in section 4B-12.

Figure 4-1 shows some possible arrangements of lenses in signal faces.

4B-10 Illumination of Lenses

Each signal lens shall be illuminated independently.

When a signal lens, except in a pedestrian signal, is illuminated and the view of such an indication is not otherwise physically obstructed, it shall be clearly visible (to drivers it controls) for a distance of at least $\frac{1}{4}$ mile under normal atmospheric conditions.

The intensity and distribution of light from each illuminated signal lens should conform to the Standard for Adjustable Face Vehicle Traffic Control Signal Heads, Revised 1970; and the Standard for Traffic Signal Lamps, December 1967.

When 12" lens signals with 150 watt lamps are placed on flashing for nighttime operation and the flashing yellow indication is so bright as to cause excessive glare, an automatic dimming device should be used to reduce the brilliance of the flashing 12" yellow.

4B-11 Visibility and Shielding of Signal Faces

Each signal face shall be so adjusted that its indications will be of maximum effectiveness to the approaching traffic for which they are intended.

Visors should be used on all signal faces to aid in directing the signal indication specifically to approaching traffic, as well as to reduce "sun phantom" resulting from external light entering the lens. Back-plates normally should be used on one-way and back-to-back two-way overhead signals, and when one signal face controls a movement.

In general, vehicular signal faces should be aimed to have maximum effectiveness for an approaching driver located a distance from the stop line equal to the distance traversed while stopping. This distance should include that covered while reacting to the signal as well as that covered while bringing the vehicle to a stop from an average approach speed. The influence of curves, grades, and obstructions should be considered in directing and locating signals.

Irregular street design frequently necessitates placing signals for different street approaches with a comparatively small angle between their indications. In these cases, each signal indication shall, to the extent practicable, be shielded or directed by visors, louvers, or other means so that an approaching driver can see only the indication controlling his movement. Tunnel visors exceeding 12" in length shall not be used on free-swinging signals.

The foregoing does not preclude the use of special signal faces such that the driver does not see their indications before seeing other indications further ahead, when simultaneous viewing of both signal indications could cause the driver to be misdirected.

4B-12 Number and Location of Signal Faces

The primary consideration in signal face placement shall be visibility. Drivers approaching a signalized intersection or other signalized area, such as a mid-block crosswalk, shall be given a clear and unmistakable indication of their right-of-way assignment. Critical elements are lateral and vertical angles of sight toward a signal face, as determined by typical driver eye position, vehicle design, and the vertical, longitudinal and lateral position of the signal face. The geometry of each intersection to be signalized, including vertical grades and horizontal curves, should be considered in signal face placement.

The visibility, location and number of signal faces for each approach to an intersection or a mid-block crosswalk shall be as follows:

1. A minimum of two signal faces for through-traffic shall be provided and should be continuously visible from a point at least the following distances in advance of and to the stop line, unless physical obstruction of their visibility exists:

85 Percentile Speed	Minimum Visibility Distance (Ft.)
20	100
25	175
30	250
35	325
40	400
45	475
50	550
55	625
60	700

2. Where physical conditions prevent drivers from having a continuous view of at least two signal indications as specified herein, a suitable sign shall be erected to warn approaching traffic. It may be supplemented by a Hazard Identification Beacon (sec. 4E-1). A beacon utilized in this manner may be interconnected with the traffic signal controller in such a manner as to flash yellow during the period when drivers passing this beacon, at the legal speed for the roadway, may encounter a red signal upon arrival at the signalized location.

3. A single signal face is permissible for the control of an exclusive turn lane. Such a signal face shall be in addition to the minimum of two signal faces for through-traffic. When the indications of a separate signal face or faces controlling an exclusive turn lane will also be visible to traffic with other allowable movements, a sign LEFT (or RIGHT) TURN SIGNAL (sec. 2B-35) shall be located adjacent to such signal face. When the face consists entirely of arrow indications, such a sign is not required.

4. Except where the width of the intersecting street or other conditions make it physically impractical, at least one and preferably both of the signal faces required by paragraph (1) above shall be located not less than 40 feet nor more than 120 feet beyond the stop line. Where both of the signal faces required by paragraph (1) above are post-mounted, they shall both be on the far side of the intersection, one on the right and one on the left or on the median island if practical. The signal face required by paragraph (3) above shall conform to the same location requirements as the signal faces required by paragraph (1) to the extent practical.

5. Except where the width of the intersecting street or other conditions make it physically impractical, at least one and preferably

both of the signal faces required by paragraph (1) above shall be located between two lines intersecting with the center of the approach lanes at the stop line, one making an angle of approximately 20 degrees to the right of the center of the approach extended, and the other making an angle of approximately 20 degrees to the left of the center of the approach extended (fig. 4-2).

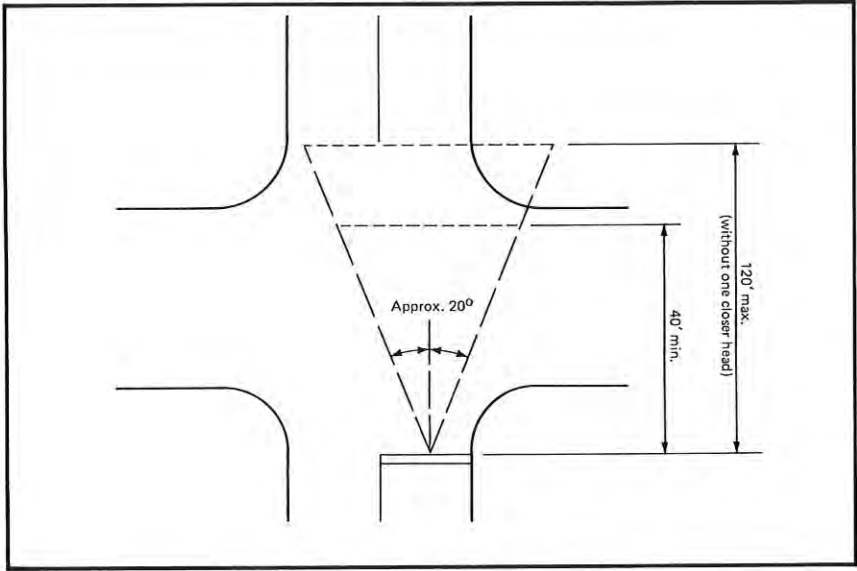


Figure 4-2. Desirable location of signal faces.

6. Near-side signals should be located as near as practicable to the stop line.

7. Where a signal face controls a specific lane or lanes of approach, its transverse position should be unmistakably in line with the path of that movement.

8. Required signal faces for any one approach shall be not less than eight feet apart measured horizontally between centers of faces.

9. When the nearest signal face is more than 120 feet beyond the stop line, a supplemental near side signal indication shall be provided.

10. A signal face mounted on a span wire or mast arm should be located as near as practicable to the line of the driver's normal view.

11. Supplemental signal faces should be used when an engineering study has shown that they are needed to achieve both advance and immediate intersection visibility. When used, they should be lo-

cated to provide optimum visibility for the movement to be controlled. The following limitations apply:

- a. Left turn arrows shall not be used in near-right faces.
- b. Right turn arrows shall not be used in far-left faces. A far-side median mount signal shall be considered as a far-left signal for this application.

At signalized mid-block crosswalks, there should be at least one signal face over the traveled roadway for each approach. In other respects, a traffic control signal at a mid-block location shall meet the requirements set forth herein.

The transverse location of a signal face, shall, if mounted on the top of a post or on a short bracket from it, conform with section 4B-14.

Supplementary pedestrian signals shall be used where warranted as provided in section 4D-3.

4B-13 Height of Signal Faces

The bottom of the housing of a signal face, not mounted over a roadway, shall not be less than 8 feet nor more than 15 feet above the sidewalk or, if none, above the pavement grade at the center of the highway.

The bottom of the housing of a signal face suspended over a roadway shall not be less than 15 feet nor more than 19 feet above the pavement grade at the center of the roadway.

Within the above limits, optimum visibility and adequate clearance should be the guiding considerations in deciding signal height. Grades on approaching streets may be important factors, and should be considered in determining the most appropriate height.

4B-14 Transverse Location of Traffic Signal Supports and Controller Cabinets

In the placement of signal supports, primary consideration shall be given to ensuring the proper visibility of signal faces as described in sections 4B-12 and 13. However, in the interest of safety, signal supports and controller cabinets should be placed as far as practicable from the edge of the traveled way without adversely affecting signal visibility.

Supports for post-mounted signal heads at the side of a street with curbs shall have a horizontal clearance of not less than two feet from the face of a vertical curb. Where there is no curb, supports for post-mounted signal heads shall have a horizontal clearance of not less than two feet from the edge of a shoulder, within the limits of normal vertical clearance. A signal support should not obstruct a crosswalk.

No part of a concrete base for a signal support should extend more than 4 inches above the ground level at any point, except that this limitation does not apply to the concrete base for a rigid (non-breakaway) support.

On medians, the above minimum clearances for signal supports should be obtained where practicable. Any supports which cannot be located with the required clearances should be of the breakaway type or should be guarded if at all practicable.

4B-15 Vehicle Change Interval

A yellow vehicle change interval shall be used following each CIRCULAR GREEN interval and, where applicable after each GREEN ARROW interval. In no case shall a CIRCULAR YELLOW indication be displayed in conjunction with the change from CIRCULAR RED to CIRCULAR GREEN. Separate signal faces should be used when exclusive turning movements are controlled by GREEN ARROWS (sec. 4B-6).

The exclusive function of the steady yellow interval shall be to warn traffic of an impending change in the right-of-way assignment.

Yellow vehicle change intervals should have a range of approximately 3 to 6 seconds. Generally the longer intervals are appropriate to higher approach speeds.

The yellow vehicle change interval may be followed by a short all-way red clearance interval, of sufficient duration to permit the intersection to clear before cross traffic is released.

A clearance interval shall be provided between the termination of a GREEN ARROW indication and the showing of a green indication to any conflicting traffic movement.

4B-16 Unexpected Conflicts During Green Interval

No movement that may involve an unexpected crossing of pathways of moving traffic should be indicated during any green interval, except when:

1. The movement involves only slight hazard;
2. Serious traffic delays are materially reduced by permitting the conflicting movement; and
3. Drivers and pedestrians subjected to the unexpected conflict are effectively warned thereof.

When such conditions of possible unexpected conflict exist, warning may be given by a sign or, by the use of an appropriate signal indication as set forth in section 4B-7. The foregoing applies to vehicle-pedestrian conflicts as well as to vehicle-vehicle conflicts.

4B-17 Coordination of Traffic Control Signals

Traffic control signals within one-half of a mile of one another along a major route or in a network of intersecting major routes should be operated in coordination, preferably with interconnected controllers. However, coordination need not be maintained across boundaries between signal systems which operate on different time cycles. Coordinated operation normally should include both pre-timed signals and traffic-actuated signals within the appropriate distances.

For coordination with railroad grade crossings signals see section 4B-21.

4B-18 Flashing Operation of Traffic Control Signals

All traffic signal installations shall be provided with an electrical flashing mechanism supplementary to the signal timer. A manual switch, or where appropriate, automatic means, shall be provided to actuate the flashing mechanism. The signal timer shall be removable without affecting the flashing operation. The mechanism shall operate in a manner similar to that of an Intersection Control Beacon (sec. 4E-3) to provide intermittent illumination of selected signal lenses.

The illuminating element in a flashing signal shall be flashed continuously at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall be not less than half and not more than two-thirds of the total flash cycle.

When traffic control signals are put on flashing operation, the signal indications given to the several streets shall be as specified in section 4B-6.

Automatic changes from flashing to stop-and-go operation shall be made at the beginning of the major street green interval, preferably at the beginning of the common major street green interval, (i.e., when a green indication is shown in both directions on the major street). Automatic changes from stop-and-go to flashing operation shall be made at the end of the common major street red interval, (i.e., when a red indication is shown in both directions on the major street).

The change from the flashing to stop-and-go operation, or from stop-and-go to flashing operation by manual switch may be made at any time.

Where there is no common major street green interval, the automatic change from flashing to stop-and-go operation shall be made at the beginning of the green interval for the major traffic movement on the major street. It may be necessary to provide a short, steady all-red interval for the other approaches before changing from flashing yellow or flashing red to green on the major approach.

4B-19 Continuity of Operation

A traffic signal installation, except as provided below, shall be operated as a stop-and-go device or as a flashing device.

When a signal installation is not in operation such as prior to placing it in service, during seasonal shutdowns, or when it is not desirable to operate the signals, they should be hooded, turned or taken down to clearly indicate that the signal is not in operation.

When a traffic signal installation is being operated in the usual (stop-and-go) manner, at least one indication in each signal face shall be illuminated.

When a traffic signal installation is being operated as a flashing device, the yellow indication shall be flashed in at least two required signal faces (sec. 4B-12) on each approach on which traffic is not stopped and the red indication shall be flashed in at least two required signal faces (sec. 4B-12) on each approach on which traffic is required to stop.

The above provisions do not apply to emergency-traffic signals or draw-bridge signals.

When a single-section, continuously illuminated GREEN ARROW lens is used alone to indicate a continuous movement, it may be continuously illuminated when the other signal indications in the signal installation are flashed.

4B-20 Signal Operation Must Relate to Traffic Flow

Traffic control signals shall be operated in a manner consistent with traffic requirements. Data from engineering studies shall be used to determine the proper phasing and timing for a signal.

Since traffic flows and patterns change, it is necessary that the engineering data be updated and re-evaluated regularly.

To assure that the approved operating pattern including timing is displayed to the driver, regular checks including the use of accurate timing devices should be made.

4B-21 Traffic Signals Near Grade Crossings

When a railroad grade crossing, protected by train-approach signals (secs. 4F-1 and 2), is within or near an intersection controlled by a traffic control signal, the control of the traffic signal should be preempted from the signal controller upon approach of trains to avoid conflicting aspects of the traffic signal and the train-approach signal. This preemption feature requires a closed electrical circuit between the control relay of the train-approach signals and the preemptor in order to establish and maintain the preempted condition during the time that the train-approach signals are in operation. Except under unusual circumstances, the interconnection should be limited to the traffic signals within 200 feet of the crossing.

Traffic control signals shall not be used on mainline railroad crossings in lieu of railroad grade crossing protection devices. However, at industrial track crossings and other places where train movements are very slow (as in switching operations), traffic control signals may be used in lieu of conventional train-approach signals to warn motorists of the approach or presence of a train. The provisions of this part relating to traffic signal design, installation and operation are applicable as appropriate where traffic control signals are so used.

At crossings where train movements are regulated or limited to the extent that train-approach signals are not required, preemption of the adjacent signalized intersections may be desirable to permit non-conflicting highway traffic to proceed during the time the crossing is blocked by a train. Except under unusual circumstances, the interconnection should be limited to the traffic signals within 200 feet of the crossing.

The preemption sequence initiated when the train first enters the approach circuit, shall at once bring into effect a signal display which will permit all vehicles to clear the tracks before the train reaches the intersection or any approach thereto.

When the green indication is preempted by train operation, a yellow change interval must be inserted in the signal sequence in the interest of safety and consistency. To avoid misinterpretation during the time that the clear-out signals are green, consideration should be given to the use of 12-inch red lenses in the signals which govern movement over the tracks (sec. 4B-8).

After the track clearance phase, the traffic control signal may be operated to permit vehicle movements that do not cross the tracks, but in all cases shall prohibit movements over the tracks.

Where feasible the location and the normal (no trains involved) phasing and timing of traffic control signals near railroad grade crossings should be designed so that vehicles are not required to stop on the tracks even though in some cases this will increase the waiting time. The exact nature of the display and the location of the signals to accomplish this will depend on the physical relationship of the tracks to the intersection area.

When the train clears the crossing it is necessary to return the signal to a designated phase, normally the traffic movement crossing the tracks.

As used herein, the terms "train" and "railroad" shall include transit vehicles operating upon stationary rails or tracks on private right-of-way.

4B-22 Emergency Operation of Traffic Signals

Systems in which traffic control signals are preempted by emergency vehicles shall operate to permit a normal change interval to

take place in the change from green to yellow to red (or flashing red) before arrival of the emergency vehicle at the preempted location. Systems in which traffic control signals are preempted by emergency vehicles shall be designed and installed so as to provide an indication to the driver of any emergency vehicle approaching an intersection when the equipment fails to preempt the traffic signal at that intersection. This indication shall be designed to be given whether the failure results from a prior preemption by an emergency vehicle on the cross street, by a railroad preemption, from equipment malfunction, or from any other cause.

Traffic signals operating in congested areas during emergency conditions should be operated in a manner designed to keep traffic moving. Prolonged all-red or flashing signal sequences are to be avoided.

4B-23 Maintenance of Traffic Control Signals

Prior to the installation of any traffic control signal, the responsibility for its maintenance should be clearly established. The responsible agency should provide for the maintenance of the signal and all of its appurtenances in a responsible manner. To this end the agency should:

1. Provide for alternate operation of the signal during a period of failure, either on flash or manually, or by having manual traffic direction by proper authority as may be warranted by traffic volumes or congestion, or by erecting other traffic control devices.
2. Have properly skilled maintenance available without undue delay for all emergency calls, including lamp failures.
3. Provide properly skilled maintenance for all components.
4. Maintain the appearance of the installation in a manner consistent with the intention of this Manual, with particular emphasis on painting and on cleaning of the optical system.
5. Service equipment and lamps as frequently as experience proves necessary to prevent undue failures.
6. Provide adequate stand-by equipment to minimize the interruption of signal operation due to equipment failure.

Every controller should be kept in effective operation in strict accordance with its predetermined timing schedule.

A careful check of the correctness of time operation of the controller should be made frequently enough to insure its operating in accordance with the planned timing schedule. Timing changes should be made only by authorized persons. A written record should be made of all timing changes.

Controllers should be carefully cleaned and serviced at least as frequently as specified by the manufacturer and more frequently if experience proves it necessary.

4B-24 Painting

The insides of visors (hoods) and the entire surface of louvers, and fins, and the front surface of backplates shall have a dull black finish to minimize light reflection to the side of the signals.

To obtain the best possible contrast with the visual background, it is desirable to paint signal head housings highway yellow.

4B-25 Vehicle Detectors

The placement of vehicle detectors in relation to the Stop line is a very important factor in the proper operation of traffic actuated signals and should be a factor in signal design.

Where the total entering traffic on one street is more than twice that on the cross street, detectors on the cross street should be placed closer to the stop line than on the main street.

Additional "calling" detectors may be required on lower volume streets to handle traffic entering the street from driveways between the basic detector and the Stop line.

The transverse placement of detectors should be such that vehicles traveling away from the intersection do not register "false-calls." On narrow two-way roadways this may require use of directional detectors.

4B-26 Auxiliary Signs

Signal instruction signs (sec. 2B-35) used with traffic signals shall be located adjacent to the signal face to which they apply. Minimum clearance of the total assembly shall conform to the provisions of sections 2A-23 and 4B-13.

Stop signs shall not be used in conjunction with any signal operation, except:

1. When the indication flashes red at all times or
2. When a minor street or driveway is located within or adjacent to the controlled area, but does not warrant separate signal control due to extremely low potential for conflict.

When used in conjunction with traffic signals, illuminated signs shall be designed and mounted in such a manner as to avoid glare and reflections that seriously detract from the signal indications. The traffic control signal shall be given dominant position and brightness to assure its target priority in the overall display.

Traffic Signal Speed signs (sec. 2D-49) may be used to inform drivers of the speed of progression, if this speed is substantially lower than the speed limits in effect on streets in the signal system.

4B-27 Removal of Confusing Advertising Lights

There should be legal authority to prohibit the display of any unauthorized sign, signal, marking, or device which interferes with the effectiveness of any official traffic control device. Specific reference is made to Section 11-205, Uniform Vehicle Code—Revised 1968.

C. WARRANTS

4C-1 Advance Engineering Data Required

A comprehensive investigation of traffic conditions and physical characteristics of the location is required to determine the necessity for a signal installation and to furnish necessary data for the proper design and operation of a signal that is found to be warranted. Such data desirably should include:

1. The number of vehicles entering the intersection in each hour from each approach during 16 consecutive hours of a representative day. The 16 hours selected should contain the greatest percentage of the 24-hour traffic.

2. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, and public-transit vehicles), during each 15-minute period of the two hours in the morning and of the two hours in the afternoon during which total traffic entering the intersection is greatest.

3. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in paragraph (2) above and also during hours of highest pedestrian volume. Where young or elderly persons need special consideration, the pedestrians may be classified by general observation and recorded by age groups as follows:

- a. under 13 years
- b. 13 to 60 years
- c. over 60 years.

4. The 85-percentile speed of all vehicles on the uncontrolled approaches to the location.

5. A conditions diagram showing details of the physical layout, including such features as intersectional geometrics, channelization, grades, sight-distance restrictions, bus stops and routings, parking conditions, pavement markings, street lighting, driveways, location of nearby railroad crossings, distance to nearest signals, utility poles and fixtures, and adjacent land use.

6. A collision diagram showing accident experience by type, location, direction of movement, severity, time of day, date, and day of week for at least one year.

The following data are also desirable for a more precise understanding of the operation of the intersection and may be obtained during the periods specified in (2) above:

1. Vehicle-seconds delay determined separately for each approach.
2. The number and distribution of gaps in vehicular traffic on the major street when minor-street traffic finds it possible to use the intersection safely.
3. The 85-percentile speed of vehicles on controlled approaches at a point near to the intersection but unaffected by the control.
4. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or a Sunday.

Adequate roadway capacity at a signalized intersection is desirable. Widening of both the main highway and the intersecting roadway may be warranted to reduce the delays caused by assignment of right-of-way at intersections controlled by traffic signals. Widening of the intersecting roadway is often beneficial to operation on the main highway because it reduces the signal time that must be assigned to side-street traffic. In urban areas, the effect of widening can be achieved by elimination of parking at intersectional approaches. It is always desirable to have at least two lanes for moving traffic on each approach to a signalized intersection. Additional width may be necessary on the leaving side of the intersection, as well as the approach side, in order to clear traffic through the intersection effectively. Before an intersection is widened, the additional green time needed by pedestrians to cross the widened streets should be checked to ensure that it will not exceed the green time saved through improved vehicular flow.

4C-2 Warrants for Traffic Signal Installation

Traffic control signals should not be installed unless one or more of the signal warrants in this Manual are met. Information should be obtained by means of engineering studies and compared with the requirements set forth in the warrants. If these requirements are not met, a traffic signal should neither be put into operation nor continued in operation (if already installed).

When a traffic control signal is indicated as being warranted, it is presumed that the signal and all related traffic control devices and markings are installed according to the standards set forth in this Manual. It is further presumed that signal indications are properly phased, that roadways are properly designed, that adjacent traffic signals are properly coordinated, that there is adequate supervision of the operation and maintenance of the signal and all of its related devices, and that the traffic signal controller will be selected on the basis of engineering study and judgment.

An investigation of the need for traffic signal control should include where applicable, at least an analysis of the factors contained in the following warrants:

Warrant 1—Minimum vehicular volume.

Warrant 2—Interruption of continuous traffic.

Warrant 3—Minimum pedestrian volume.

Warrant 4—School crossings.

Warrant 5—Progressive movement.

Warrant 6—Accident experience.

Warrant 7—Systems.

Warrant 8—Combination of warrants.

4C-3 Warrant 1, Minimum Vehicular Volume

The Minimum Vehicular Volume warrant is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 1

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both ap- proaches)	Vehicles per hour on higher-volume minor-street ap- proach (one di- rection only)
Major Street	Minor Street		
1 -----	1 -----	500	150
2 or more -----	1 -----	600	150
2 or more -----	2 or more -----	600	200
1 -----	2 or more -----	500	200

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85-percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the minimum vehicular volume warrant is 70 percent of the requirements above (in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities).

4C-4 Warrant 2, Interruption of Continuous Traffic

The Interruption of Continuous Traffic warrant applies to operating conditions where the traffic volume on a major street is so heavy

that traffic on a minor intersecting street suffers excessive delay or hazard in entering or crossing the major street. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 2

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both ap- proaches)	Vehicles per hour on higher-volume minor-street ap- proach (one di- rection only)
Major Street	Minor Street		
1 -----	1 -----	750	75
2 or more -----	1 -----	900	75
2 or more -----	2 or more -----	900	100
1 -----	2 or more -----	750	100

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85-percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the interruption of continuous traffic warrant is 70 percent of the requirements above (in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities).

4C-5 Warrant 3, Minimum Pedestrian Volume

The Minimum Pedestrian Volume warrant is satisfied when, for each of any 8 hours of an average day, the following traffic volumes exist:

1. On the major street, 600 or more vehicles per hour enter the intersection (total of both approaches); or where there is a raised median island 4 feet or more in width, 1,000 or more vehicles per hour (total of both approaches) enter the intersection on the major street; and

2. During the same 8 hours as in paragraph (1) there are 150 or more pedestrians per hour on the highest volume crosswalk crossing the major street.

When the 85-percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the minimum pedestrian volume warrant is 70 percent of the re-

quirements above (in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities).

A signal installed under this warrant at an isolated intersection should be of the traffic-actuated type with push buttons for pedestrians crossing the main street. If such a signal is installed at an intersection within a signal system, it should be equipped and operated with control devices which provide proper coordination.

Signals installed according to this warrant shall be equipped with pedestrian indications conforming to requirements set forth in other sections of this Manual.

Signals may be installed at nonintersection locations (mid-block) provided the requirements of this warrant are met, and provided that the related crosswalk is not closer than 150' to another established crosswalk. Curbside parking should be prohibited for 100' in advance of and 20' beyond the crosswalk. Phasing, coordination, and installation must conform to standards set forth in this Manual. Special attention should be given to the signal head placement and the signs and markings used at nonintersection locations to be sure drivers are aware of this special application.

4C-6 Warrant 4, School Crossing

A traffic control signal may be warranted at an established school crossing when a traffic engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at the school crossing shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (sec. 7A-3).

When traffic control signals are installed entirely under this warrant:

1. Pedestrian indications shall be provided at least for each crosswalk established as a school crossing.
2. At an intersection, the signal normally should be traffic-actuated. As a minimum, it should be semi-traffic-actuated, but full actuation with detectors on all approaches may be desirable. Intersection installations that can be fitted into progressive signal systems may have pretimed control.
3. At non-intersection crossings, the signal should be pedestrian-actuated, parking and other obstructions to view should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new non-intersection installation.

4C-7 Warrant 5, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections where they would not otherwise be warranted, in order to maintain proper grouping of vehicles and effectively regulate group speed. The Progressive Movement warrant is satisfied when:

1. On a one-way street or a street which has predominantly uni-directional traffic, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning and speed control, or

2. On a two-way street, adjacent signals do not provide the necessary degree of platooning and speed control and the proposed and adjacent signals could constitute a progressive signal system.

The installation of a signal according to this warrant should be based on the 85-percentile speed unless an engineering study indicates that another speed is more desirable.

The installation of a signal according to this warrant should not be considered where the resultant signal spacing would be less than 1,000 feet.

4C-8 Warrant 6, Accident Experience

The Accident Experience warrant is satisfied when:

1. Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and

2. Five or more reported accidents, of types susceptible of correction by traffic signal control, have occurred within a 12-month period, each accident involving personal injury or property damage to an apparent extent of \$100 or more; and

3. There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the minimum vehicular volume warrant, the interruption of continuous traffic warrant, or the minimum pedestrian volume warrant; and

4. The signal installation will not seriously disrupt progressive traffic flow.

Any traffic signal installed solely on the Accident Experience warrant should be semi-traffic-actuated (with control devices which provide proper coordination if installed at an intersection within a coordinated system) and normally should be fully traffic-actuated if installed at an isolated intersection.

4C-9 Warrant 7, Systems Warrant

A traffic signal installation at some intersections may be warranted to encourage concentration and organization of traffic flow networks.

The Systems warrant is applicable when the common intersection of two or more major routes has a total existing, or immediately projected, entering volume of at least 800 vehicles during the peak hour of a typical weekday, or each of any five hours of a Saturday and/or Sunday.

A major route as used in the above warrant has one or more of the following characteristics:

1. It is part of the street or highway system that serves as the principal network for through traffic flow;
2. It connects areas of principal traffic generation;
3. It includes rural or suburban highways outside of, entering or traversing a city;
4. It has surface street freeway or expressway ramp terminals;
5. It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

4C-10 Warrant 8, Combination of Warrants

In exceptional cases, signals occasionally may be justified where no single warrant is satisfied but where two or more of Warrants 1, 2, and 3 are satisfied to the extent of 80 percent or more of the stated values.

Adequate trial of other remedial measures which cause less delay and inconvenience to traffic should precede installation of signals under this warrant.

4C-11 Factors Governing Selection of Type of Control

The principal factors that may lead to the favorable consideration of traffic-actuated control in the selection of the type of signal control include:

1. Low, fluctuating or unbalanced traffic volumes.
2. High side street traffic volumes and delays only during the peak hours.
3. The pedestrian or accident warrant is the only warrant which is met.
4. The installation is to provide for one-way movement of two-way traffic.
5. The installation is at a non-intersection location.

4C-12 Pedestrian-Actuated Control

Operation of traffic-actuated signals must take into consideration the needs of pedestrians as well as vehicular traffic. This can be accomplished in the following ways:

1. When pedestrian signals are not warranted in conjunction with a traffic-actuated signal installation (sec. 4D-3) but where occasional

pedestrian movement exists and there is inadequate opportunity to cross without undue delay, pedestrian detectors shall be installed and operated as prescribed in sections 4D-6 and 7.

2. When pedestrian signals are not otherwise warranted but a pedestrian movement exists which would not have adequate crossing time during the green interval, pedestrian signals and detectors shall be installed and operated as prescribed in sections 4D-6 and 7.

3. When pedestrian signals are warranted and installed in conjunction with a traffic-actuated signal, the operation should follow the patterns described in sections 4D-6 and 7.

D. PEDESTRIAN SIGNALS

4D-1 Pedestrian Signal Indications

Pedestrian signal indications are special types of traffic signal indications intended for the exclusive purpose of controlling pedestrian traffic. These indications consist of the illuminated words WALK and DONT WALK.

4D-2 Meaning of Pedestrian Indications

The meanings of pedestrian signal indications are as follows:

1. The DONT WALK indication, steadily illuminated, means that a pedestrian shall not enter the roadway in the direction of the indication.

2. The DONT WALK indication, while flashing, means that a pedestrian shall not start to cross the roadway in the direction of the indication, but that any pedestrian who has partly completed his crossing during the steady WALK indication shall proceed to a sidewalk, or to a safety island.

3. The WALK indication, steadily illuminated, means that pedestrians facing the signal indication may proceed across the roadway in the direction of the indication.

4. The WALK indication, while flashing, means that there is a possible conflict of pedestrians with vehicles.

4D-3 Applications of Pedestrian Signal Indications

Pedestrian signal indications shall be installed in conjunction with vehicular traffic signals (which meet one or more of the traffic signal warrants previously set forth) under any of the following conditions:

1. When a traffic signal is installed under the pedestrian volume or school crossing warrant.

2. When an exclusive interval or phase is provided or made available for pedestrian movement in one or more directions, with all conflicting vehicular movements being stopped.

3. When vehicular indications are not visible to pedestrians such as on one-way streets, at "T" intersections; or when the vehicular indications are in a position which would not adequately serve pedestrians.

4. At established school crossings at intersections signalized under any warrant.

Pedestrian signal indications also may be installed under any of the following conditions:

1. When any volume of pedestrian activity requires use of a pedestrian clearance interval to minimize vehicle-pedestrian conflicts or when it is necessary to assist pedestrians in making a safe crossing.

2. When multi-phase indications (as with split-phase timing) would tend to confuse pedestrians guided only by vehicle signal indications.

3. When pedestrians cross part of the street, to or from an island, during a particular interval (where they should not be permitted to cross another part of that street during any part of the same interval).

4D-4 Design Requirements

Design requirements for pedestrian signals include the following:

1. Pedestrian indications should attract the attention of, and be readable to, the pedestrian (both day and night) at all distances from 10 feet to the full width of the area to be crossed.

2. All pedestrian indications shall be rectangular in shape and shall consist of the lettered messages WALK and DONT WALK. Only internal illumination shall be used (fig. 4-3).

3. When illuminated, the WALK indication shall be lunar white conforming to the Standard for Adjustable Face Pedestrian Signal Heads, 1963.⁶ All except the letters shall be obscured by an opaque material.

4. When illuminated, the DONT WALK indication shall be Portland orange conforming to the Standard for Adjustable Face Pedestrian Signal Heads, 1963, with all except the letters obscured by an opaque material.

5. When not illuminated, the WALK and DONT WALK messages shall not be distinguishable by pedestrians at the far end of the crosswalk they control.

6. The letters shall be at least 3 inches high for a crossing where the distance from the near curb to the pedestrian signal indication is 60 feet or less. For distances over 60 feet, the letters should be at least 4½ inches high.

⁶ Available from the Institute of Traffic Engineers, Washington, D.C. 20006.

7. The light source shall be designed and constructed so that in case of an electrical or mechanical failure of the word DONT, the word WALK of the DONT WALK message will also remain dark.



Single Section with Cut-out Letters



Two Section Type

Figure 4-3. Pedestrian signal face designs.

4D-5 Location

Pedestrian signal faces shall be mounted with the bottom of the housing not less than 7 feet nor more than 10 feet above the side-

walk level, and so there is a pedestrian indication in the line of pedestrians' vision which pertains to the crosswalk being used.

The DONT WALK indication shall be mounted directly above or integral with the WALK indication.

Pedestrian signal heads may be mounted separately or on the same support with other signal heads. When mounted with other signal heads there shall be a physical separation between the two heads.

The pedestrian signal head shall be so positioned and adjusted as to provide maximum visibility at the beginning of the controlled crossing.

4D-6 Detectors

Pedestrian detectors of the push-button or other type shall be designated to operate on a circuit not to exceed 18 volts. They may be mounted on signal standards, wood or steel poles, or individual posts. They should be conveniently located near each end of crosswalks where actuation is required. A mounting height of $3\frac{1}{2}$ to 4 feet above the sidewalk has been found best adapted to general usage. Permanent-type signs (sec. 2B-35) shall be mounted above or in unit with the detectors, explaining their purpose and use. At certain locations, it may be desirable to supplement this sign with a larger sign suspended over the sidewalk to call attention to the push button. Where two crosswalks, oriented in different directions, end at or near the same location, the positioning of pedestrian push buttons should clearly indicate which crosswalk signal is actuated by each push button. Additional push-button detectors may be required on islands or medians where a pedestrian might become stranded.

Special purpose push-buttons (to be operated only by authorized persons) should include a housing capable of being locked to prevent access by the general public. Instruction signs are not necessary in this case.

A pilot light or other means of indication may be installed with a pedestrian push button and normally shall not be illuminated. Upon actuation, it shall be illuminated until the pedestrian's green or WALK indication is displayed.

4D-7 Pedestrian Intervals and Phases

The four basic combinations of pedestrian signal intervals with vehicular signal operation are as follows:

1. Combined Pedestrian-Vehicular Interval—a signal phasing wherein pedestrians may use certain crosswalks and vehicles are per-

mitted to turn across these crosswalks (the pedestrian indication shall be flashing WALK).

2. Exclusive Crosswalk Interval—a signal phasing wherein pedestrians may use certain crosswalks but vehicles are not permitted to move across these crosswalks during the pedestrian movement (the pedestrian indication shall be steady WALK).

3. Leading Pedestrian Interval—a signal phasing wherein an exclusive pedestrian interval, in advance of the vehicular indication shall be steady WALK. When the leading pedestrian interval is terminated, and a combined pedestrian-vehicular interval begins, the WALK indication may begin to flash.

4. Exclusive Pedestrian Phase—a signal phasing wherein pedestrians may proceed to cross the intersection in any direction during an exclusive phase while all vehicles are stopped (the pedestrian indication shall be steady WALK).

Pedestrians should be assured of sufficient time to cross the roadway at a signalized intersection. Where traffic signals are of the actuated type, control equipment should provide sufficient pedestrian crossing time when there has been a pedestrian actuation and the minimum vehicular time is less than that needed by the pedestrians. Where traffic signals are not of the vehicle-actuated type, pedestrian actuation may be used to provide sufficient pedestrian crossing time, or the vehicular time should be adjusted to provide the crossing time needed by pedestrians.

Under normal conditions, the WALK interval should be at least 7 seconds, so that pedestrians will have adequate opportunity to leave the curb, before the clearance interval is shown. However, the WALK interval itself need not equal or exceed the total crossing time calculated for the street width, as many pedestrians will complete their crossing during the flashing DONT WALK clearance interval.

A pedestrian clearance interval shall always be provided where pedestrian signal indications are used. It shall consist of a flashing DONT WALK indication. The duration should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb and travel to the center of the farthest traveled lane before opposing vehicles receive a green indication (normal walking speed is assumed to be 4 feet per second). On a street with a median at least 6 feet in width, it may be desirable to allow only enough pedestrian clearance time on a given phase to clear the crossing from the curb to the median. In the latter case, if the signals are pedestrian-actuated, an additional detector shall be provided on the island (sec. 4D-6).

When a traffic signal installation is being operated as a flashing device, the pedestrian indications shall not be illuminated.

E. OTHER HIGHWAY TRAFFIC SIGNALS**4E-1 Hazard Identification Beacon**

A Hazard Identification Beacon is one or more sections of a standard traffic signal head with a flashing CIRCULAR YELLOW indication in each section. Typical applications include:

1. Obstructions in or immediately adjacent to the roadway.
2. Supplemental to advance warning signs.
3. At mid-block crosswalks.
4. At intersections where warning is required.
5. Supplemental to regulatory signs, except the STOP, YIELD and DO NOT ENTER signs.

A Hazard Identification Beacon shall be used only to supplement an appropriate warning or regulatory sign or marker. The beacon shall not be included within the border of the sign.

Hazard Identification Beacons, when used at intersections, shall not face conflicting vehicular approaches.

4E-2 Speed Limit Sign Beacon

A Speed Limit Sign Beacon is two CIRCULAR YELLOW lens sections each having a visible diameter of not less than six inches, as an alternate, one or more CIRCULAR YELLOW lenses, each having a visible diameter of not less than eight inches. Where two lenses are used, they shall be vertically aligned, and they shall be alternately flashed.

A Speed Limit Sign Beacon is intended for use with a fixed or variable speed limit sign. Where applicable, a flashing speed limit beacon (with an appropriate accompanying sign) may be used to indicate that the speed limit shown is in effect.

4E-3 Intersection Control Beacon

An Intersection Control Beacon consists of one or more sections of a standard traffic signal head, having flashing CIRCULAR YELLOW or CIRCULAR RED indications in each face. They are installed and are used only at an intersection to control two or more directions of travel. Supplemental indications may be needed on one or more approaches in order to provide adequate visibility to approaching motorists.

Intersection Control Beacons are intended for use at intersections where traffic or physical conditions do not justify conventional traffic signals but where high accident rates indicate a special hazard.

Application of Intersection Control Beacons shall be limited to:

1. Yellow on one route (normally the major roadway) and red for the remaining approaches.
2. Red for all approaches (where all-way stop is warranted).

A stop sign should be used with a flashing red intersection control beacon (fig. 4-4).

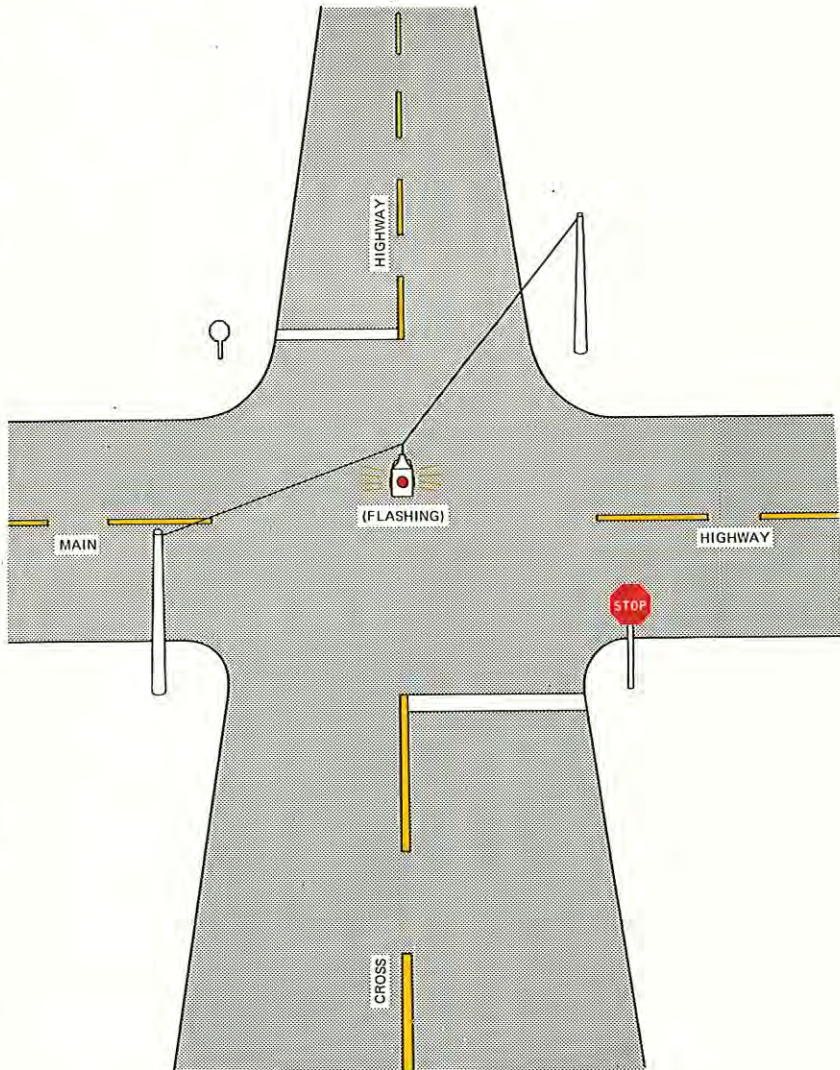


Figure 4-4. Typical intersection control beacon installation.

Flashing yellow indications shall not face conflicting vehicular approaches.

4E-4 Stop Sign Beacon

A Stop Sign Beacon is one or two sections of a standard traffic signal head with a flashing CIRCULAR RED indication in each section. Where two lenses are used, they shall be the 8" nominal diameter size, aligned horizontally and they shall be flashed simultaneously. Where a single lens is used, it may be either 8" or 12" nominal diameter.

The bottom of the housing of a Stop Sign Beacon shall be not less than 12 nor more than 24 inches above the top of a stop sign (sec. 2B-4).

4E-5 General Design and Operation of Beacons

Flashing beacon units and their mounting shall follow the general design specifications for traffic control signals, which shall include the following essentials:

1. Each signal unit lens shall have a visible diameter of not less than 8 inches, except for Speed Limit Sign Beacons described in section 4E-2.

2. When illuminated, the beacon shall be clearly visible (to all drivers it faces) for a distance of at least $\frac{1}{4}$ mile under normal atmospheric conditions unless otherwise physically obstructed.

3. The red and yellow lens colors shall be in accordance with the requirements of the Standard for Adjustable Face Vehicle Traffic Control Signal Heads, Revised 1970.⁷

All flashing contacts should be equipped with filters for suppression of radio interference.

Beacons shall be flashed at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle. When hazard identification beacons have more than one section, they may be flashed alternately.

Beacons should be operated only during those hours when the hazard or regulation exists.

A flashing yellow beacon interconnected with a traffic signal controller may be used with an advance traffic signal warning sign (sec. 2C-16).

If a 150 watt lamp is used in a 12" lens flashing yellow beacon and the flashing yellow is so bright as to cause excessive glare during night operation, an automatic dimming device should be used to reduce the brilliance during night operation.

⁷ Available from the Institute of Traffic Engineers, Washington, D.C. 20006.

4E-6 Hazard Identification Beacon Location

The hazard or other condition warranting Hazard Identification Beacons should largely govern their location with respect to the roadway. If used alone and located at the roadside, the bottom of the beacon unit shall be at least 8 feet and not more than 12 feet above the pavement. If suspended over the roadway, the clearance above the pavement shall not be more than 19 feet nor less than 15 feet. In no case should they be mounted on pedestals in the roadway unless the pedestal is within the confines of a traffic or pedestrian island. Where an obstruction is in or adjacent to the roadway, illumination of the lower portion or the beginning of the obstruction, or a sign on or in front of the obstruction is desirable, in addition to the beacon.

4E-7 Intersection Control Beacon Location

An Intersection Control Beacon is generally suspended over the center of an intersection; however, it may be used at other suitable locations. If suspended over the roadway the clearance above the pavement shall be at least 15 feet but not more than 19 feet. If pedestal mounting is used, the bottom of the signal head shall be at least 8 feet but not more than 15 feet above the pavement. In no case should it be mounted on a pedestal in the roadway unless the pedestal is within the confines of a traffic or pedestrian island.

4E-8 Lane-use Control Signals

Lane-use control signals are special overhead signals having indications used to permit or prohibit the use of specific lanes of a street or highway or to indicate the impending prohibitions of use. Installations are distinguished by placement of these special signals over a certain lane or lanes of the roadway and by their distinctive shapes and symbols. Supplementary signs are often used to explain their meaning and intent.

Lane-use control signals are most commonly used for reversible-lane control. This type of control should be used only when a competent engineering study shows that there is need and also that the planned operation is practicable. Reversible-lane operation may be appropriate at toll-booth areas.

Lane-use control signals also may be used where there is no intent or need to reverse lanes. Some applications of this type are:

1. On a freeway, where it is desired to keep traffic out of certain lanes at certain hours to facilitate the merging of traffic from a ramp or other freeway.
2. On a freeway, near its terminus, to indicate a lane that ends.
3. On a freeway or long bridge, to indicate a lane which may be temporarily blocked by an accident, breakdown, etc.

4E-9 Meaning of Lane-use Control Signal Indications

The meanings of lane-use control signals are as follows:

1. A steady DOWNWARD GREEN ARROW means that a driver is permitted to drive in the lane over which the arrow signal is located.

2. A steady YELLOW X means that a driver should prepare to vacate, in a safe manner, the lane over which the signal is located because a lane control change is being made, and to avoid occupying that lane when a steady RED X is displayed.

3. A flashing YELLOW X means that a driver is permitted to use a lane over which the signal is located for a left turn, using proper caution.

4. A steady RED X means that a driver shall not drive in the lane over which the signal is located, and that this indication shall modify accordingly the meaning of all other traffic controls present. The driver shall obey all other traffic controls and follow normal safe driving practices.

4E-10 Design of Lane-use Control Signals

All lane-use control signal indications shall be in units with rectangular faces. Nominal minimum height and width of each face shall be 12 inches for typical applications. However, other sizes with message recognition distances appropriate to signal spacing may be employed for unusual applications.

Each lane to be reversed shall have signal faces with a DOWNWARD GREEN ARROW on an opaque background, and a RED X symbol on an opaque background. Signal faces with a YELLOW X symbol on an opaque background may be provided for operation as described in section 4E-12.

Each nonreversible lane immediately adjacent to a reversible lane shall have a DOWNWARD GREEN ARROW displayed to traffic traveling in the permitted direction and a RED X symbol displayed in the opposite direction. Other nonreversible lanes on any street so controlled may also be provided with these indications.

The indications provided for each lane may be in separate units or may be superimposed in the same unit. When in separate units, the RED X symbol shall be on the left, the YELLOW X symbol, if used, shall be in the middle and the DOWNWARD GREEN ARROW symbol shall be on the right.

The color of lane-use control signal indications shall be clearly visible for $\frac{1}{4}$ mile at all times under normal atmospheric conditions, unless otherwise physically obstructed.

The visibility angle of the lane-use control signal shall be at least as great as that specified for the standard circular traffic signal (sec. 4B-11).

4E-11 Location of Lane-use Control Signals

Lane-use control signal units shall be located approximately over the center of the lane controlled.

If the area to be controlled is more than $\frac{1}{4}$ mile in length, or if the vertical or horizontal alignment is curved, intermediate lane-use control signal indications shall be placed over each controlled lane at frequent intervals. This placement shall be such that a motorist will at all times be able to see at least one indication, and preferably two (due to the possibility of a burnout of a single indication) along the roadway, and will have a definite indication of the lanes specifically reserved for his use.

All lane-use control indications shall be located in a straight line across the roadway at right angles to the roadway alignment.

The bottom of any lane-use control signal unit shall be not less than 15 feet nor more than 19 feet above the pavement grade.

On roadways having intersections controlled by traffic signals, the lane-use control indication shall be placed sufficiently far in advance of or beyond such traffic signals to prevent them from being mis-construed as traffic control signals. Twelve-inch lenses may be necessary in the intersection traffic control signals to aid in distinguishing between the two types of signals.

4E-12 Operation of Lane-use Control Signals

All reversible-lane control signals shall be coordinated and wired to a master control which will operate so as to permit signal indications for each direction in any of the reversing lanes to change from a steady RED X to a DOWNWARD GREEN ARROW or from a DOWNWARD GREEN ARROW to a steady YELLOW X when used, and then to a steady RED X. The showing of a DOWNWARD GREEN ARROW or steady YELLOW X or any combination thereof, in both directions over the same lane, shall be guarded against by electrical interlock.

During change-over periods, a steady YELLOW X indication may be used to notify traffic in a reversible lane to prepare to vacate the lane. Alternatively the steady RED X may immediately follow the termination of the steady DOWNWARD GREEN ARROW, and in this case a clearance period of appropriate length shall be provided, during which the steady RED X shall be shown in both directions over the lane before the steady DOWNWARD GREEN ARROW indication is shown for traffic from the opposite direction.

Where feasible, a flashing YELLOW X for both directions may be used over a lane to permit use of that lane for left turns, with due caution.

The type of control provided for reversible-lane operation should be such as to permit either automatic or manual operation of the lane-use control signals. If an automatic system is used, a manual control to over-ride the automatic control shall be provided.

When used, lane-use signals shall be operated continuously.

4E-13 Traffic Signals at Drawbridges

Signals installed at drawbridges are a special type of highway traffic signal, the purpose of which is to notify traffic to stop because of the road closure rather than alternately giving the right-of-way to conflicting traffic movements. They are manually operated in coordination with the opening and closing of the drawbridge, and with the operation of gates, barriers, or other devices used to warn, control and stop vehicles. Unlike traffic control signals, drawbridge signals may be operated frequently or at extremely infrequent intervals depending upon the nature of the physical conditions and waterway traffic.

4E-14 Application of Drawbridge Signals

Drawbridge signals shall always be used in conjunction with gates and other types of protection commonly employed at drawbridges.

4E-15 Design of Drawbridge Signals

The signal heads and mountings of drawbridge signals shall follow the standard design specifications for traffic control signals. Drawbridge signals may be supplemented with bells to provide additional warning to drivers and pedestrians.

Nominal 8-inch signal indications are standard. However, if prevailing approach speeds are in excess of 25 miles per hour, or when considerations such as roadway width or geometrics, signal location, conflicting lights or objects in the background, etc., indicate the need for greater signal effectiveness, signal heads with 12-inch diameter lenses and 100-watt or larger lamps should be provided.

Where physical conditions prevent a driver (traveling at the 85 percentile approach speed) from having a continuous view of at least one signal indication for approximately 10 seconds before reaching the stop line, an auxiliary device shall be provided. This device may be either an auxiliary signal or a DRAWBRIDGE AHEAD sign with a Hazard Identification Beacon interconnected with the drawbridge controller.

A DRAWBRIDGE AHEAD sign shall always be used at the proper distance from the drawbridge to give advance warning to motorists, except in urban conditions where such signing would not

be feasible. Such signs shall be supplemented by a Hazard Identification Beacon (sec. 4E-1) under the conditions described above as well as for other conditions. It is desirable to control this beacon from the bridge-tender's station so it will be flashed only when needed to warn of drawbridge operation.

Since drawbridge operation covers so wide a range of time periods between openings, two types of signals are provided and engineering judgment must be exercised in determining which to use under particular circumstances. The first type consists of the standard three-color (red, yellow, and green) traffic signal indications, generally to be used when drawbridge operation is quite frequent. The second type consists of two red signal indications in vertical array separated by a STOP HERE ON RED sign (sec. 2B-35).

4E-16 Location of Drawbridge Signals

Two signal indications shall be provided for each approach to the movable span. One signal shall be at the right side of the roadway, and the other at the left side or over the left half of the roadway, directly across the roadway from the right hand indication. Insofar as practicable, the height and lateral placement of signals at drawbridges should conform to the requirements for other traffic control signals. They should ordinarily be from 20 to 50 feet in advance of the first gate or other barrier.

4E-17 Operation of Drawbridge Signals

Signals at drawbridges shall be interconnected with the drawbridge gates or other warning or control devices, and with the movable span, so that signals, gates and movable span are controlled manually by the bridge tender through an interlocked switching control. Signals on adjacent streets and highways should be interconnected with the drawbridge control, if indicated by engineering considerations. If the drawbridge is close to a railroad grade crossing and there is a possibility that traffic may be stopped on the crossing as a result of the bridge opening, a supplementary traffic signal coordinated with the drawbridge signal should be provided to prevent traffic from being stopped on the railroad crossing. Extreme care should be used in planning such signal installations to avoid creating confusion or hazardous conditions.

Where bridge openings are frequent and the three-color type of signal is used, the green signal shall be illuminated at all times between bridge opening periods. When the bridge is to be opened, the signal shall change to yellow for a predetermined interval (normally approximately 3 to 5 seconds) and shall change to red not less than 15 seconds before the gates or other devices begin to operate to

close the roadway. While the gates are closed, the signals shall show a continuous red indication. After the bridge has been closed and the gates have been opened, the signal indications shall return to steady green. The sequence of signal, gate and bridge operation shall be automatic, through interconnection with the bridge control mechanism. The duration of each signal indication interval, except the yellow interval, shall therefore be controlled by the bridge operation.

Where bridge openings are less frequent or where for some other reason the double-red type of signal installation is selected, the signal shall not be illuminated between bridge opening periods. When the bridge tender initiates the bridge opening procedure, the signal shall start alternate flashing of the red indications. After a minimum period of approximately 20 seconds, the gates may be lowered. When the bridge has been again closed and the gates have been raised, the red signal indications shall be discontinued.

When a Hazard Identification Beacon is used with the DRAW-BRIDGE AHEAD sign (sec. 4E-15) it should be interconnected with the drawbridge controller in such a manner as to begin operation sufficiently in advance of the beginning of the bridge opening signal sequence as to warn drivers that they will encounter a red signal or vehicles stopped by the signal. It may frequently be desirable to continue this beacon in flashing operation after the drawbridge cycle has been completed until all stopped vehicles have started to move and traffic is again flowing freely.

4E-18 Traffic Signals for Emergency Vehicle Movements

An emergency-traffic signal is a special adaptation of a traffic control signal to obtain the right-of-way for an authorized emergency vehicle. An emergency-traffic signal may be installed at a location that does not meet the warrants prescribed for the various types of other traffic signal installations. It may be installed at an intersection or at other locations where there is direct access from a building housing the emergency vehicle.

Right-of-way for emergency vehicles at signalized locations shall be obtained as specified in section 4B-22.

4E-19 Applications of Emergency-Traffic Signals

At an unsignalized location, an emergency-traffic signal may be justified if adequate gaps in traffic do not exist to permit safe entrance of emergency vehicles, or the stopping sight distance for vehicles approaching on the through street is insufficient to permit safe entrance of emergency vehicles.

The sight distance determination is based on the location of the visibility obstruction for the critical approach lane for each street or drive, and the posted or 85th percentile speed on the through street, whichever is higher.

If warrants for a traffic control signal (sec. 4C) are met, a signal normally should be installed to the standards required for that type of signal (sec. 4B).

The use of emergency-traffic signals to permit direct access to a street from a building housing emergency equipment is optional.

4E-20 Design of Emergency-Traffic Signals

Except as specified in this section, a traffic control signal for emergency vehicle movements shall meet the requirements of this Manual.

At least one signal face should be located over the roadway.

A sign, legible at all times, bearing the legend EMERGENCY SIGNAL should be mounted adjacent to each signal face.

A Hazard Identification Beacon may be installed in advance of an emergency-traffic signal. Such beacon shall be accompanied by an appropriate warning sign. The design and location of the beacon shall conform to the standards specified in sections 4E-1 and 4E-5.

A minimum of one signal face shall face the direction of approach of the emergency vehicle.

4E-21 Operation of Emergency-Traffic Signals

As a minimum, the indications, sequence and manner of operation of an emergency traffic control signal installed at a mid-block location shall be as follows:

1. The signal indication, between emergency vehicle actuations, shall be either a steady green or flashing yellow.

2. There shall always be a steady yellow change indication shown to traffic on the street, but a change indication is not required for the emergency vehicle driveway.

3. There shall be a steady red signal indication for traffic on the street. The duration of the red period should be determined on the basis of on-site test run-time studies, but should normally not exceed 1.5 times the emergency vehicle passage or clearance time.

4. It has been found advantageous to use the following size lenses: 12" diameter for red and steady yellow indications, and 8" diameter for flashing yellow indications and steady green indications. Other appropriate means to reduce the flashing yellow light output may be used.

An intersectional or mid-block emergency-traffic signal may be actuated manually from a local control point such as a fire station, police headquarters or civil defense office, or from an emergency vehicle equipped for remote operation of the signal.

Hazard Identification Beacons, used with an emergency-traffic signal, shall be actuated from a non-illuminated condition at the same time as the emergency-traffic signal is changed to steady yellow.

Emergency-traffic signals located at intersections should be operated either in the flashing mode between emergency actuations (sec. 4B-18) or should be semi- or fully traffic-actuated, to accommodate normal vehicular and pedestrian traffic on the streets.

F. TRAIN-APPROACH SIGNALS AND GATES

4F-1 Railroad-Highway Grade-Crossing Protection

At railroad-highway grade-crossings where studies indicate the need of protection beyond that provided by signs, signals should be installed which indicate the approach or presence of trains. The signals may be supplemented by gates which extend across the lane or lanes of the approaching traffic while trains are approaching and occupying the crossing. The following sections apply only to signals, with or without gates as described in Railroad-Highway Grade-Crossing Protection, Bulletin No. 6, Association of American Railroads:⁸

Where traffic signals are located at intersections in close proximity to the train-approach signals, particular attention must be given to the coordination of the two installations (sec. 4B-21).

As used herein, the terms "train" and "railroad" shall include transit vehicles operating upon stationary rails or tracks on private or separate right-of-way.

The applicable techniques of railroad grade-crossing protection also should be considered for the grade-crossings of other preemptive-type traffic using exclusive rights-of-way.

4F-2 Application of Railroad Grade Crossing Signals, Gates and Variable Signs

A flashing-light signal is used to indicate the approach or presence of trains by means of two horizontal red lights flashing alternately at predetermined intervals.

A railroad-highway grade-crossing gate (appearing to the driver as an arm being lowered or in a horizontal position) is an effective adjunct to the flashing light signal in indicating the approach or

⁸ Association of American Railroads, Train Operations, Control and Signals Committee, Railroad-Highway Grade Crossing Protection, Bulletin No. 6, Washington, D.C. 1966.

presence of trains. When used, the gate should extend over the traveled roadway a sufficient distance to cover the lanes used by traffic approaching the crossing.

A NO RIGHT TURN or NO LEFT TURN variable sign is used to indicate turn prohibitions required upon the approach or presence of trains by presenting the legend NO RIGHT TURN or NO LEFT TURN.

Signals and signs or signals, signs and gates of the type described herein shall be installed at railroad-highway grade-crossings where a study of the crossing by competent engineers indicates a need for advance warning of the approach of trains. These exact assemblies of devices shall be used for no other purpose.

4F-3 Proper Motorist Response to Railroad-Highway Grade-Crossing Signals

Whenever a clearly visible electric or mechanical signal device is activated, a crossing gate is lowered, or a human flagman gives or continues to give a signal indicating the approach or passage of a railroad train, the driver of an approaching vehicle should:

1. Stop within 50 feet, but not less than 15 feet, from the nearest rail of such railroad and shall not proceed until he can do so safely and,
2. No person shall drive any vehicle through, around or under any crossing gate or barrier at a railroad crossing while such gate or barrier is closed or is being opened or closed.

4F-4 Types of Control, Design, Location, Installation, Operation and Maintenance

The types of control, design, location, installation, operation and maintenance of railroad-highway grade-crossing signals shall be in accordance with AAR Bulletin #6 (sec. 4F-1), except as modified in this section.

The transverse location of railroad-highway grade-crossing signals shall comply with the requirements of section 4B-14.

The railroad-highway grade-crossing gate arms shall be striped on both sides with 16-inch alternate diagonal reflectorized stripes of red and white.

Part V. ISLANDS

A. GENERAL

5A-1 Scope of Island Standards

A traffic-control island is a defined area between traffic lanes for control of vehicle movements or for pedestrian refuge. Within an intersection area, a median or an outer separation is considered to be an island. An island may be designated by paint, raised bars, mushroom buttons, curbs, guideposts, pavement edge, or other devices.

For the purposes of this Manual, an island includes not only the designated area but also all end protection and approach end treatments.

It should be realized that islands constitute an integral part of the geometric design of streets and highways and should be included in overall projects for construction. At times, however, an island may need to be installed at an existing intersection to improve or correct an outdated design. This Manual treats primarily the traffic-control characteristics of islands rather than their design features; however, certain minimum standards are given. Other features of island design are presented to be used as guidelines.

5A-2 Legal Authority

All traffic islands shall be installed by the authority of the public body or official having jurisdiction. For those islands that are elements of street and highway design and are included in the design of the street or highway, no specific authority is required.

5A-3 Classification and Function

Islands frequently serve more than one purpose but may be generally classified according to their main function as follows:

1. Pedestrian refuge islands.
2. Traffic divisional islands.
3. Traffic channelizing islands.

5A-4 Pedestrian Refuge Islands

The specific function of a refuge island is to provide a place of safety for pedestrians who cannot cross the entire roadway width

at one time in safety because of changing traffic signals or on-coming traffic.

Refuge islands are particularly useful at intersections in urban areas where there is a considerable amount of pedestrian traffic and where heavy volumes of vehicular traffic make it difficult and dangerous for pedestrians to cross, such as:

1. On multi-lane roadways.
2. In large or irregularly shaped intersections.
3. At signalized intersections to provide a place of safety between different traffic streams.

When refuge islands are required at each intersection along a street, consideration should be given to providing a continuous median divider strip between intersections.

Passenger loading islands are considered to be a special class of refuge islands inasmuch as they serve as a pedestrian refuge while loading and unloading passengers from transit vehicles.

5A-5 Traffic Divisional Islands

The function of divisional islands is to separate opposing traffic; also, they may be used to separate traffic in the same direction, e.g., to divide left-turn traffic in a median lane from the through traffic. Divisional islands are used to guide traffic around an obstruction within the roadway (such as a bridge pier), in advance of an intersection to separate opposing traffic and may be located to prevent overtaking and passing at hazardous points, such as sharp curves or narrow underpasses.

Where divisional islands are continuous, they are called medians; the more important functions are as follows:

1. Medians provide an insulating area between opposing streams of moving traffic.
2. Medians provide protection and control of cross and turning traffic.
3. Medians provide a refuge for pedestrians.

5A-6 Traffic Channelizing Islands

The primary function of a channelizing island is to control and direct a motorist into the proper channel for his intended route. Channelizing islands may be installed in areas that otherwise would be broad expanses of pavement, to bring about an orderly flow of traffic.

Channelization is particularly helpful at streets intersecting at oblique angles, at 3-leg junctions, and at multileg intersections.

Traffic channelizing islands may be provided for separation (and special control) of turning movements.

B. DESIGN**5B-1 General**

The necessity for islands should be determined only by careful study, since they are placed in an area that would otherwise be available for vehicular traffic. This is particularly true for a channelizing island because the shape and size of the island will vary widely according to the intersection conditions. For this reason, it may be desirable to test the layout by temporarily delineating channelizing islands before final installation.

Islands should be carefully planned and designed to provide travel paths that are obvious, easy to follow, and continuous so as not to constitute a hazard in the roadway.

The number of channelizing islands used at any intersection should be kept to a minimum and the entire layout should be the simplest design that will accomplish the desired intersection control. Usually a few carefully placed islands of above-minimum size are more effective than a greater number of small islands which create multiple channels and cause confusion.

Islands should be clearly visible at all times and from a position sufficiently in advance so that the motorist will not be surprised by their presence. Islands should occupy the minimum of roadway space needed for the purpose and yet be of sufficient size to be noticeable.

The approach nose of a divisional or pedestrian refuge island which separates opposing traffic movements should be offset to the left, as faced by approaching traffic. The right curb of the island should form a diverging taper to deflect traffic toward the right. Where a channelizing or divisional island is introduced between two lanes of traffic moving in the same direction, similar offsets should be used, to the extent that space permits, on each side of the nose to direct traffic into the separate roadways.

Criteria for the design of islands are contained in A Policy on Geometric Design of Rural Highways, 1965, and A Policy on Arterial Highways in Urban Areas, 1957.¹

5B-2 Size and Shape

Islands generally are either narrow and elongated or triangular in shape. The size should be governed by site conditions and the function of the island. An island should be large enough to command attention.

¹ Available from the American Association of State Highway Officials, 341 National Press Building, Washington, D.C. 20004.

For rural conditions, triangular islands should be at least 50 square feet and preferably 75 square feet. For urban conditions where speeds are low, islands about two-thirds this size may be acceptable. Elongated islands should be not less than 4 feet wide and 20 feet long. In special cases where space is limited, elongated islands may be as narrow as 2 feet, except where used as pedestrian refuge areas, and as short as 12 feet.

Refuge islands should preferably be at least 6 feet and in no case less than 4 feet wide. The usable length along the roadway, including any section at pavement level at the crosswalk, should not be less than 12 feet or the width of crosswalk, whichever is greater.

Where possible, the width of a divisional island should be sufficient to provide a refuge area for vehicles crossing or turning at intersections, preferably 30–40 feet. The minimum desirable width of a median which will accommodate a turning lane is 16 feet. Where right-of-way is severely limited, median widths of 12 feet have been used with a 10-foot turning lane.

Generally, divisional islands should not be placed where they will confine either side of the roadway to less than two through traffic lanes, except when a short island is used on two-lane roads carrying relatively low volumes of traffic.

5B-3 Designation of Island Areas

Easy recognition of islands by approaching motorists is necessary for efficient and safe operation. The forms or means of designating island areas vary, depending on their sizes, locations, and functions, and also the character of the adjacent area, rural or urban. An important consideration, in all locations, is to provide a contrast in color, and preferably texture, between islands and adjacent pavements.

Generally, islands should present the least potential hazard to approaching vehicles and yet perform their intended functions. When curbs are used, the mountable type is preferable except where a barrier curb is essential for traffic control or pedestrian refuge. Barrier curb also may be used on islands where traffic control devices are installed.

Islands may be designated as follows:

1. Raised and outlined by curbs and filled with pavement, turf, or other material.
2. Formed by pavement markings (sometimes supplemented by buttons or raised bars or flexible stanchions on all-paved areas).
3. Unsurfaced areas (sometimes supplemented by delineators, guideposts, or other devices).

Landscaping, where used, should be carefully planned to provide unrestricted visibility for motorists and pedestrians. Since pedestrian refuge and channelizing islands are located in the line of the traveled-way, no physical obstructions, other than traffic control devices should be placed in the islands.

C. APPROACH END TREATMENT

5C-1 General

The approach end of an island or group of islands must be carefully designed to provide a maximum degree of warning of the presence of the island and a definite indication of the proper vehicle path or paths to be followed. This applies to the approach to all refuge and directional islands and to individual divisional islands, but is not applicable to island ends at median openings on a divided street or highway and may not be necessary at secondary islands located within a multiple-island intersection.

5C-2 Method

Various methods of approach-end treatment have been used with satisfactory results: contrasting pavement colors or textures, raised bars, buttons, and median blocks. In addition to these physical changes in pavement surface, various types of illumination (sec. 5D), signing (sec. 5E) and markings (sec. 5F) are necessary to provide adequate visibility, warning, and delineation.

The ends of islands first approached by traffic should be preceded by a gradually diverging marking on the roadway surface, so as to guide vehicles into desired paths of travel along the island edge. These markings may contain slightly raised (usually less than 1 inch high) sections of coarse aggregate or other suitable material (jiggle bars) that may be crossed readily even at considerable speeds. These jiggle bars provide increased visibility of the marked section and produce a rumbling noise under traffic.

Higher raised bars or buttons may be used in advance of islands having barrier curbs, but they should not be used where they constitute an unexpected hazard. These devices should not project more than 1 to 3 inches above the pavement surface, so that any wheel encroachment within the area will become obvious to the vehicle driver without a resultant loss of control of the vehicle. Where practical, such bars or buttons may be preceded by jiggle bars or their height should be gradually increased as approached by traffic. Pavement markings may be used with raised bars or buttons to better designate the island area.

D. ILLUMINATION

All islands and the proper channels of travel through them should be made clearly visible at night by adequate reflectorization and/or illumination. Illumination of refuge islands, including their approach-end treatment, should be sufficient to show the general layout of the island and immediate vehicular travel paths, with the greatest concentration of illumination at points of possible danger to pedestrians or vehicles, as at barrier curbs or other structures.

E. SIGNS

5E-1 General

Although safety and efficiency of operation of sections of roadways adjacent to islands depends to a considerable degree on the geometric design, the physical layout should be supplemented by effective signing as a means of informing, warning, and controlling drivers. Sign planning should be coordinated with the physical layout prior to completion of design. Signing cannot correct an improper geometric design feature.

5E-2 Application

Many standard signs (Part II) are applicable and needed because of the existence of islands.

All approach noses of islands in the line of traffic should be designated by an appropriate sign and/or marker. All signs used on islands shall be reflectorized and/or illuminated. Signs are to be used where the island is sufficiently wide, at least 1 foot wider than the sign. On narrower islands, a reflectorized object marker (sec. 3C-1) shall be used.

Appropriate signs for use on island approach noses are:

1. KEEP RIGHT (sec. 2B-24), where all traffic is required to pass to the right of the island nose.
2. KEEP LEFT (sec. 2B-24), where all traffic is required to pass to the left of the island nose.
3. Double Arrow warning sign (sec. 2C-34), where traffic may pass to either side of the island and a special warning is needed such as at loading and refuge islands.
4. Guide signs such as route marker assemblies or destination signs at large intersection channelizing islands.

These signs should be placed well back from the approach nose of the island to reduce the likelihood of being struck by a vehicle. Because they are viewed from a location considerably in advance of the island, they can be set back distances up to 50-75 feet in rural

areas, and yet present a proper perspective. Where posts are likely to constitute a hazard, they shall be designed to break off or yield when struck by a vehicle.

The above signs may not be necessary or even desirable at secondary islands located within a multiple-island intersection or at intermediate ends of divisional islands and medians. Object markers (sec. 3C-1), are frequently beneficial at such locations to accentuate the ends of the islands without presenting a cluttered arrangement of signs.

Usually signs will not be installed on islands designated only by painted markings on the pavement. When experience indicates that signing is necessary for proper roadway usage, the islands generally should be defined by curbs or means other than paint alone.

Other signs that may be necessary for the orderly flow of traffic at channelized intersections include: Turn Prohibition (sec. 2B-15), DO NOT ENTER (sec. 2B-25), and ONE WAY (sec. 2B-28).

F. MARKINGS

5F-1 General

Definition of proper travel path of vehicles is necessary for islands to function efficiently. Reflectorized pavement markings and delineators should be provided to furnish an uninterrupted guidance system.

5F-2 Application

Markings, as related to islands, consist of pavement and curb markings, object markers and delineators.

On the approach to islands, the triangular neutral area, just in advance of the end of the island, is to include pavement markings as provided in section 3B-13. As indicated in section 5C-2, it is desirable that jiggle bars (or other contrast in pavement surface) also be applied in these neutral areas. When raised bars or buttons are used, they should be marked with white or yellow reflectorizing materials, as determined by the direction(s) of travel they separate (sec. 3D-3).

5F-3 Colors

Islands, outlined by curbs or pavement markings should be marked with reflectorized white or yellow material as determined by the direction(s) of travel they separate (secs. 3B-9 and 10, 3D-3).

On very long islands, curb reflectorization need not extend for the entire length of the curb, especially if the island is illuminated or

marked with delineators. It should be sufficiently long to denote the general alignment of the edge of the island along which vehicles travel, including the approach nose, when viewed from the approach to the island.

5F-4 Object Markers

Object markers (sec. 3C-1) should be used on island approach noses to indicate the presence of a raised curb or other obstruction. The marker should be used even where a sign is installed as indicated in section 5E-2. They may also be needed to define ends of other islands to make them more conspicuous at night, particularly where illumination is not provided.

5F-5 Delineators

Where delineators are used with island installations, they shall be white or, when facing wrong-way traffic, they shall be red (sec. 3D-4). Each travel path through an intersection must be considered separately in positioning delineators to assure maximum effectiveness.

Part VI. TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS

A. INTRODUCTION AND GENERAL SPECIFICATIONS

6A-1 Need for Standards

Problems of traffic control occur when traffic must be moved through or around road or street construction, maintenance operations, and utility work. No one standard sequence of signs or other control devices can be set up as an inflexible arrangement for all situations due to the variety of conditions encountered.

The following treatment of signs, signals, and markings for street and highway construction and maintenance work provides a comprehensive guide to be applied as a national standard. This Part of the Manual establishes principles to be observed in the design, installation, and maintenance of traffic control devices, and prescribes standards where possible, and is designed so that it can be used independently. To that end some material concerning specifications and devices having more general application is repeated here from preceding parts of this Manual.

These principles and standards are directed to the safe and expeditious movement of traffic through construction and maintenance zones and to the safety of the work force performing these operations.

6A-2 Scope

This Part sets forth basic principles and prescribes standards for the design, application, installation, and maintenance of the various types of traffic control devices required for road or street construction, maintenance operations and utility work. These include signs, signals, lighting devices, markings, barricades, channelizing, and hand signaling devices. Minimum standards of application are prescribed for typical situations, and for methods of controlling traffic through work areas. As part of these standards a number of typical situations are illustrated, showing the proper application of standard protective devices.

6A-3 Application of Standards

The general principles outlined in this Manual are applicable to both rural and urban areas. Since it is not practical to prescribe

detailed standards of application for all the situations that may conceivably arise, minimum standards are presented here for the most common situations. It is emphasized that these are minimum desirable standards for normal situations and that additional protection must be provided when special complexities and hazards prevail. The protection prescribed for each situation shall be based on the speed and volume of traffic, duration of operation, and exposure to hazards. As used in this Part the term street refers to all the streets in any municipality, including cities, towns, villages, or other local jurisdictions.

Traffic conditions on streets are characterized by relatively low speeds, wide ranges of volumes, limited maneuvering space, frequent turns and cross movements, a significant pedestrian movement and other obstructions. Construction and maintenance operations are more numerous and varied, including such diverse activities as pavement cuts for utility work, pavement patching and surfacing, pavement marking renewal and encroachments by adjacent building construction. Work on arterial streets should be restricted to off-peak hours to minimize conflicts with traffic.

Rural highways are characterized by lower volumes, higher speeds, and less interference from pedestrians, turns, and encroachments.

Limited access highways present problems requiring a special effort by administrators, supervisors, and work forces. Both high speeds and high volumes may be anticipated, with peak flows restricting work to relatively short periods during daylight hours.

The difficulties associated with the completion of work on lanes carrying high volumes of traffic have made it necessary in some instances to schedule construction and/or maintenance operations at night. While night scheduling avoids peak flows, the problems associated with work site delineation and warning device placement are increased.

Although each situation must be dealt with individually, conformity with the provisions established herein is required. In particular situations not adequately covered by the provisions of this Manual, the protection of the traveling public and of the workmen on the scene will dictate the measures to be taken, consistent with the general principles set forth herein.

6A-4 Responsibility

The provisions for public protection established herein are for application by (1) State highway department, county, and municipal forces performing construction or maintenance operations on roads and streets, (2) contractors employed in road or street construction or maintenance under contract to any governmental author-

ity, and (3) all others, including employees of public utility companies, performing any work on highways or so closely adjacent as to create hazards for the public or for themselves.

These standards, as a part of the Manual on Uniform Traffic Control Devices, should be adopted by all public authorities concerned with highways, and should be given effect by official instructions to employees and by incorporation into the specifications for all contracts.

It is important that the authorities having jurisdiction be able to require proper protection, that responsibility be clearly assigned, adequate training of personnel be provided, and that there be adherence to the standards and provisions of this Manual.

6A-5 General Requirements

All traffic control devices used on road or street construction or maintenance work shall conform to the applicable specifications of this Manual.

Traffic control devices shall be installed at the inception of construction or maintenance operations, and shall be properly maintained and/or operated during the time such special conditions exist. They shall remain in place only as long as they are needed and shall be immediately removed thereafter. Where operations are performed in stages, there shall be in place only those devices that apply to the conditions present. Signs that do not apply to existing conditions shall be removed, covered, or turned so as not to be readable by oncoming traffic. Barricades and sign supports shall be constructed and erected in a workmanlike manner.

Weeds, shrubbery, construction materials or equipment, spoil, etc., shall not be allowed to obscure any traffic control device.

B. SIGNS

General

6B-1 Design of Signs

Street or highway construction and maintenance signs fall into the same three major categories as do other traffic signs; namely, Regulatory signs, Warning signs, and Guide signs. Many signs normally used elsewhere will also find application for signing construction and maintenance operations. Special construction and maintenance signs follow the basic standards for all highway signs as to shape. Warning signs in construction areas shall have a black legend on an orange background. Existing yellow warning signs already in place within these areas may remain in use. Color for other signs shall follow the standard for all highway signs.

The use of stripes (other than the standard border) or other geometric patterns or contrasting colors on or around any sign in an attempt to make it more conspicuous, distracts attention from the message, and defeats the purpose of maintaining uniformity and simplicity of design. Such practice is contrary to standards and is accordingly disapproved. However, the use of standard orange flags or yellow flashing warning lights in conjunction with signs is permitted, so long as they do not interfere with a clear view of the sign face.

The dimensions of signs shown herein are for standard sizes, which may be increased wherever necessary for greater legibility or emphasis. On secondary highways and city streets smaller signs may be used if authorized by lawful authority. Deviations from standard sizes as prescribed herein shall be in six-inch increments.

Standard sign sizes and colors are shown in the illustrations of the individual signs rather than in detailed specifications in the text. Where the orange background is specified and reflectorization is not required, a fluorescent material may be used for increased daytime visibility.

6B-2 Illumination and Reflectorization

All signs intended to be used during hours of darkness shall be reflectorized or illuminated. Where there is serious interference from extraneous light sources and a reflectorized installation is not likely to give effective performance, an illuminated sign should be used. Sign illumination may be either internal or external. When the full face of the sign is outlined by internal illumination, thereby indicating the shape of the sign, background reflectorization is not required. Where external illumination is provided, the light source should be properly shielded to protect drivers from glare. Torches or lanterns are for warning or guidance, and shall not be used for sign illumination. Street or highway lighting is not regarded as meeting the requirements for sign illumination.

6B-3 Position of Signs

Signs shall be placed in positions where they will convey their messages most effectively and placement must therefore be accommodated to highway design and alignment. Signs shall be so placed that the driver will have adequate time for response.

As a general rule signs shall be located on the right-hand side of the street or roadway. Where special emphasis is deemed necessary, dual installations may be made which consist of duplicate signs opposite each other on the left and right sides of the roadway, respectively. Within a construction or maintenance zone, however, it is often necessary and/or desirable to erect signs on portable sup-

ports placed within the roadway itself. It is also permissible to mount appropriate signs on barricades.

Standards for height and lateral clearance of roadside signs are shown in figure 6-1. Signs mounted on barricades, or temporary supports, may be at lower heights but the bottom of the sign shall be not less than one foot above the pavement elevation. Higher mounting heights are, however, desirable.

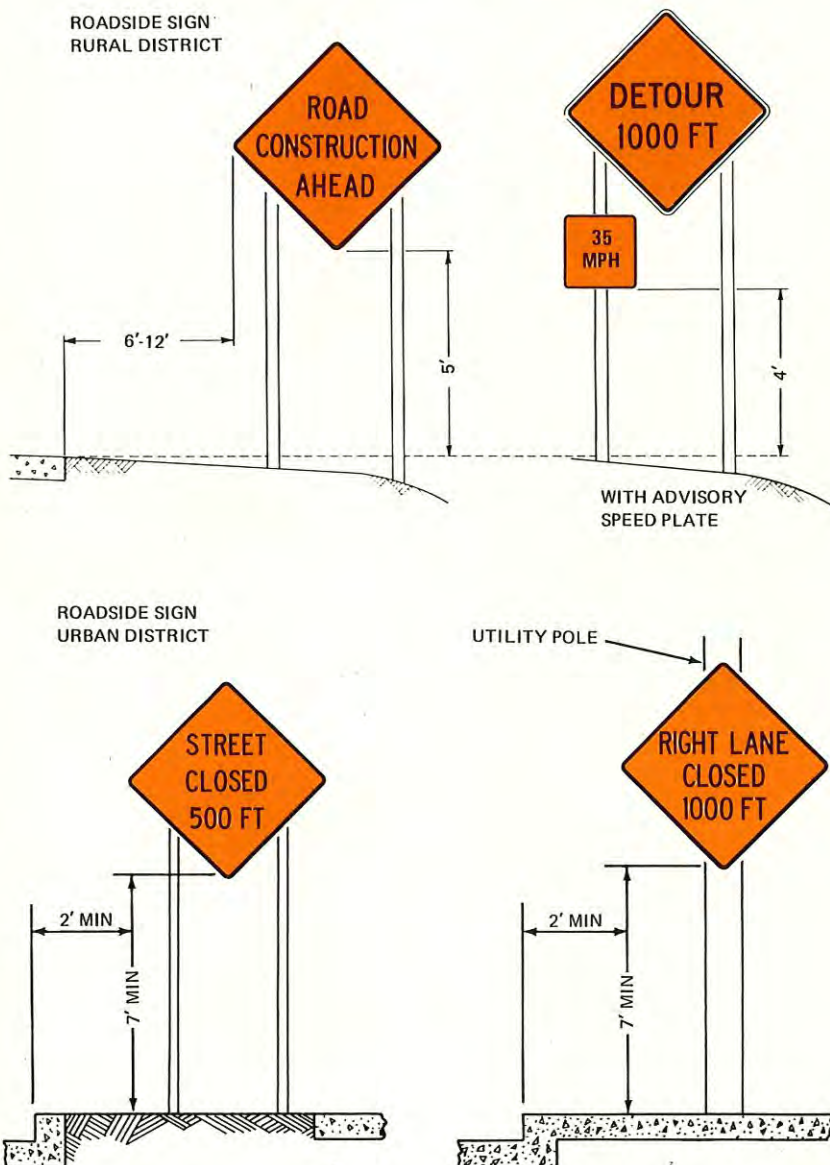


Figure 6-1. Height and lateral location of signs—typical installations.

Where open highway conditions prevail on the approach to the work site, advance warning signs should be placed approximately 1,500 feet in advance of the condition to which they are calling attention. Where a series of advance warning signs are used, the

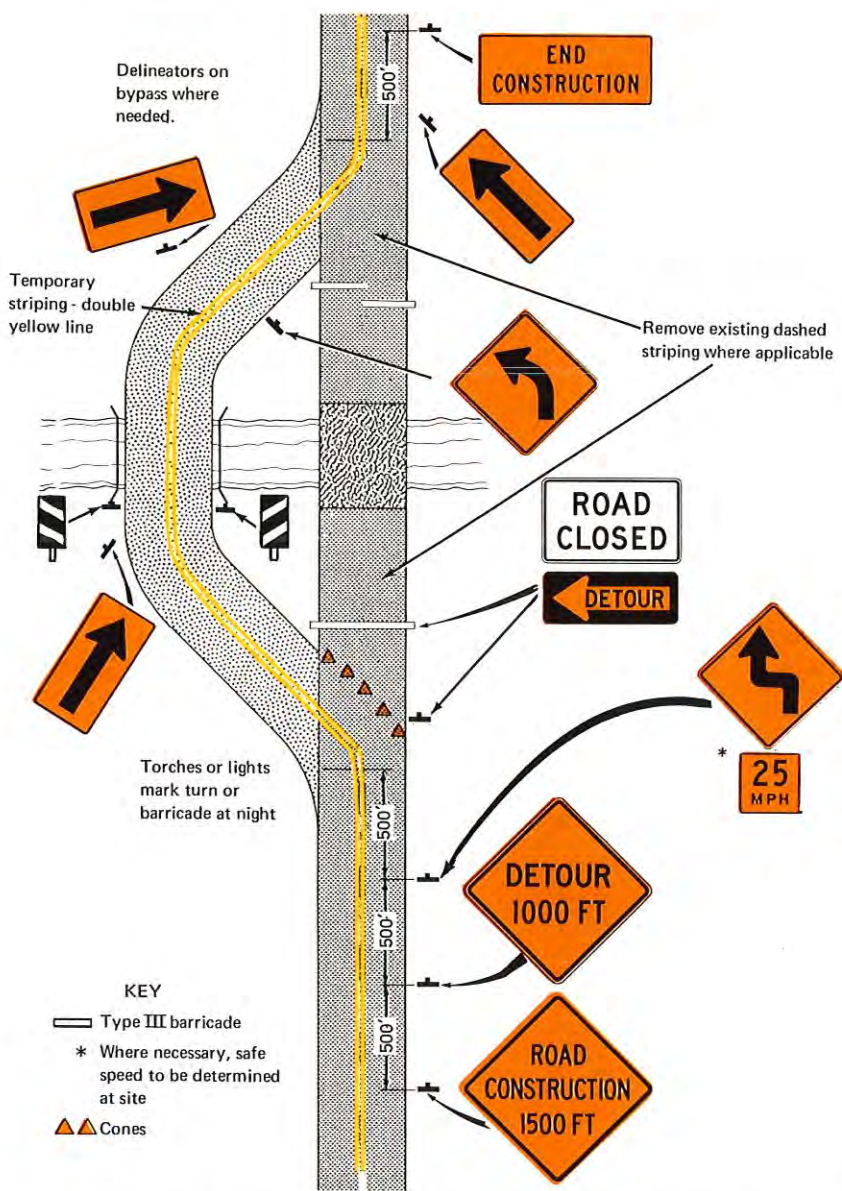


Figure 6-2. Typical applications of traffic control devices on 2-lane highway where the entire roadway is closed and a bypass detour is provided (signs shown for one direction of travel only).

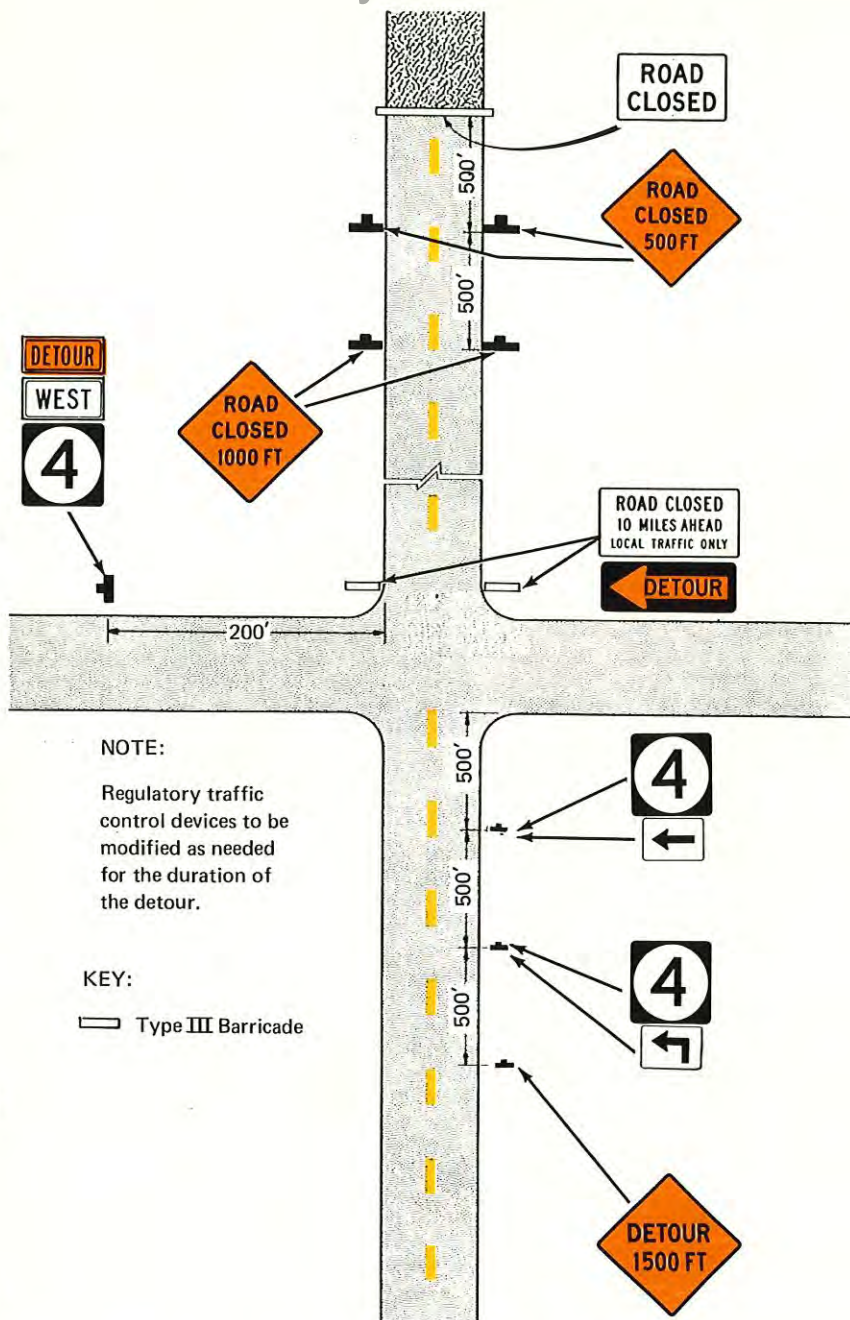


Figure 6-3. Typical application—roadway closed beyond detour point.

warning sign nearest the work site should be placed approximately 500 feet from the point of restriction with the additional signs at 500–1000 foot intervals. On expressway and limited access facilities, the advance warning distance should be increased to one-half mile or more. On city streets, where more restrictive conditions generally prevail on the approach to the work area, signs in the

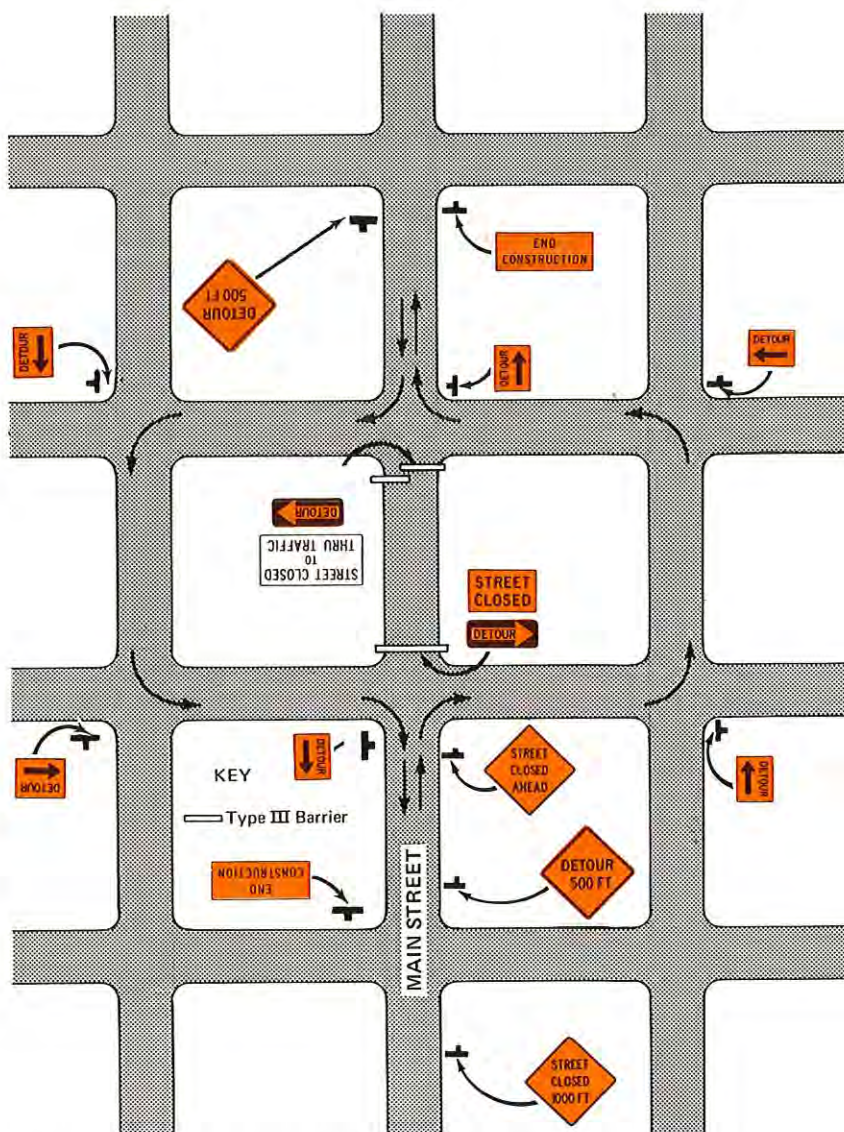


Figure 6-4. Typical application—detour signing for street construction project in a street grid.

immediate vicinity of the work may be placed at closer spacings. Typical sequences and spacings of advance warning signs are shown in figures 6-2 to 6-10.

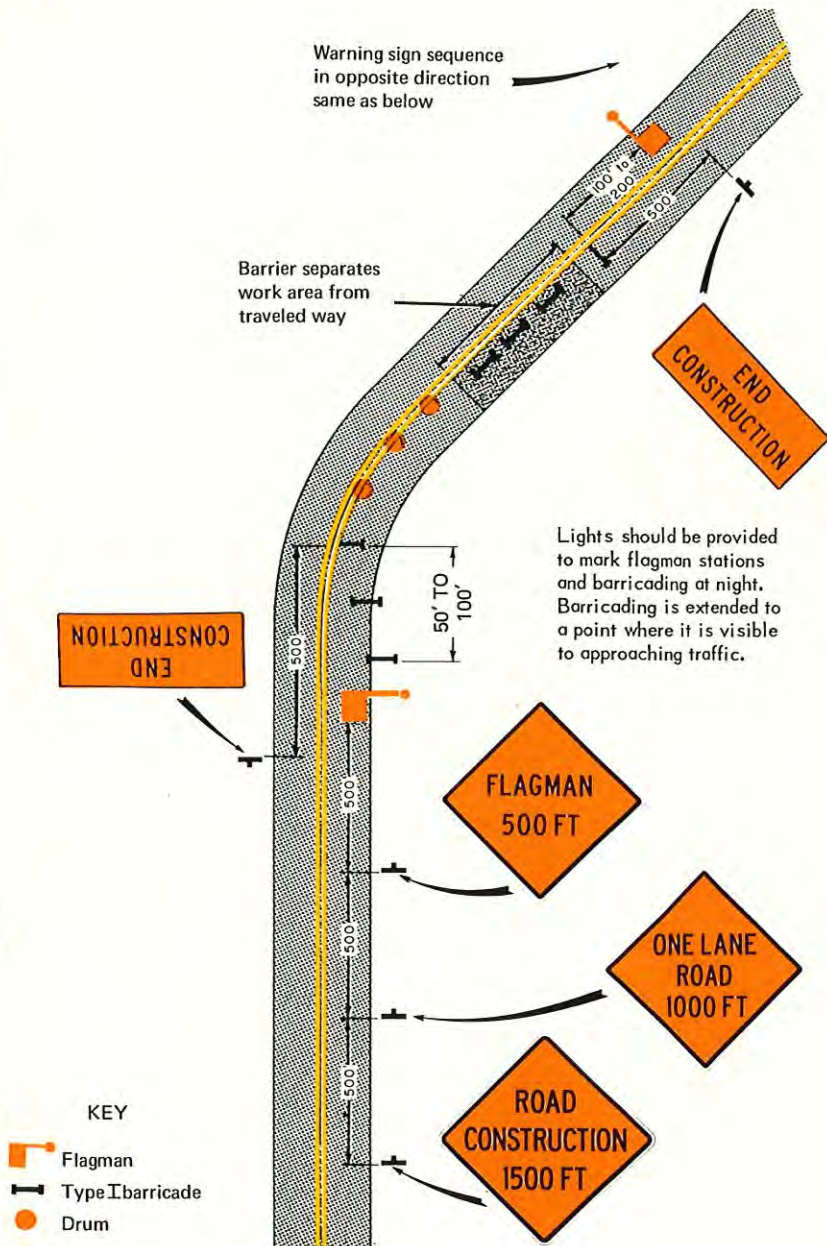


Figure 6-5. Typical applications of traffic control devices on 2-lane highway where one lane is closed.

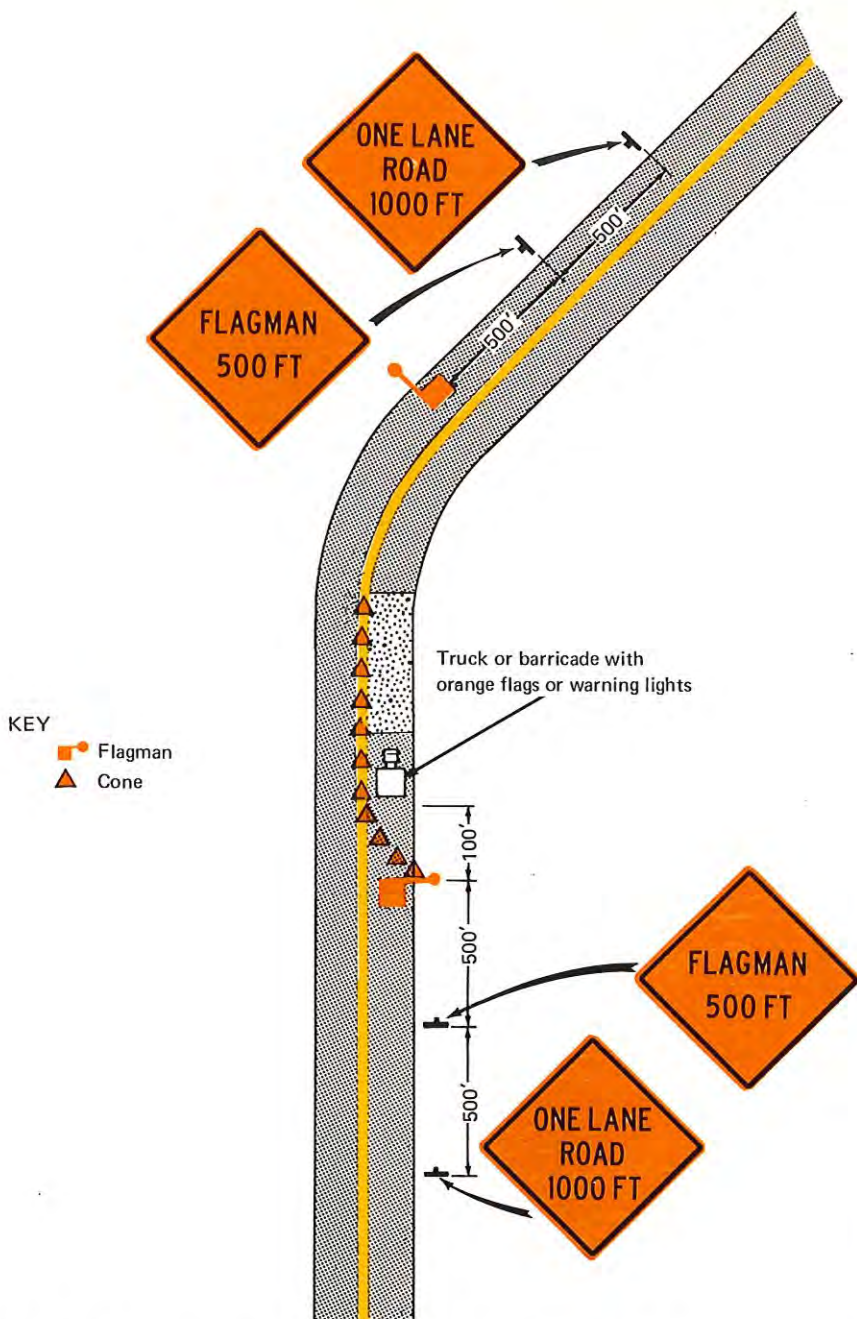


Figure 6-6. Typical application—maintenance operations of short duration on a 2-lane roadway.

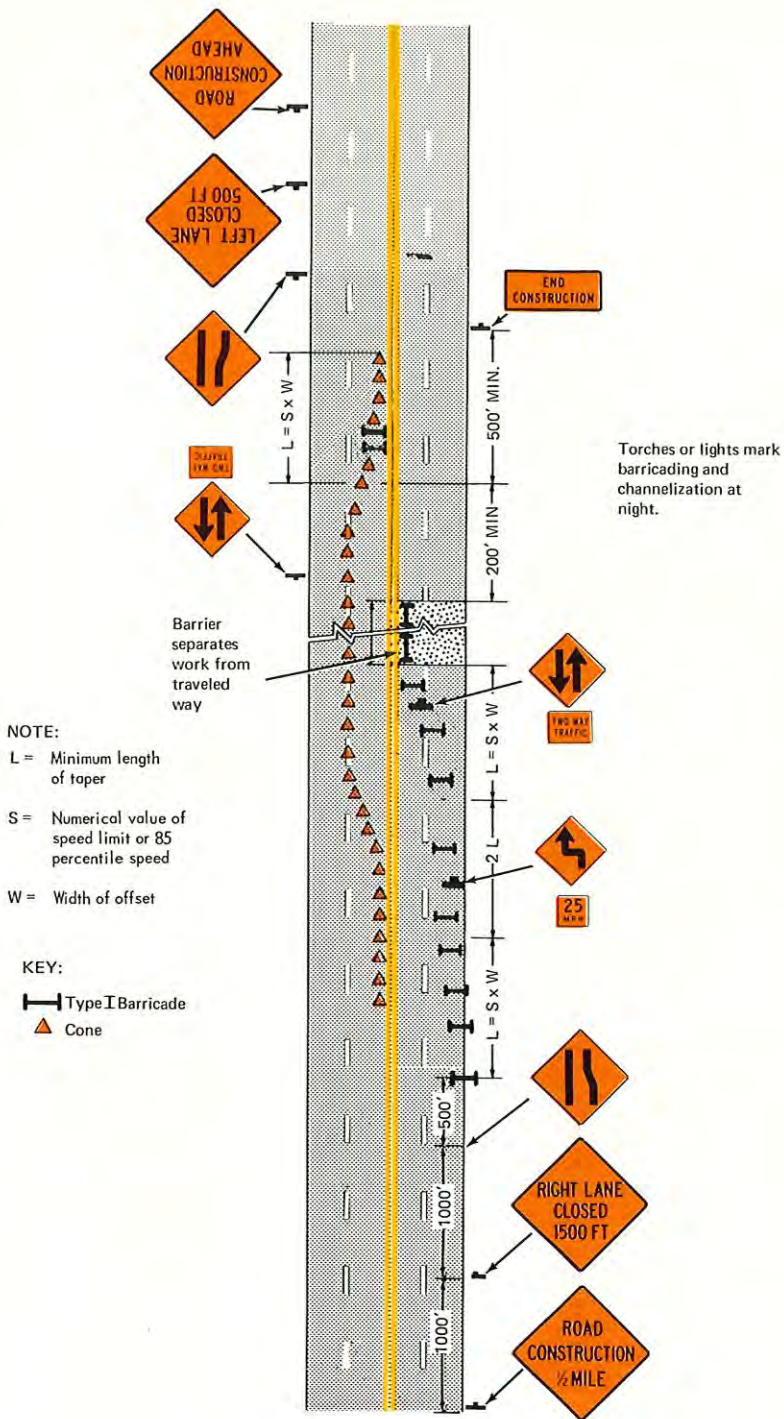


Figure 6-7. Typical application—4-lane undivided roadway where half the roadway is closed.

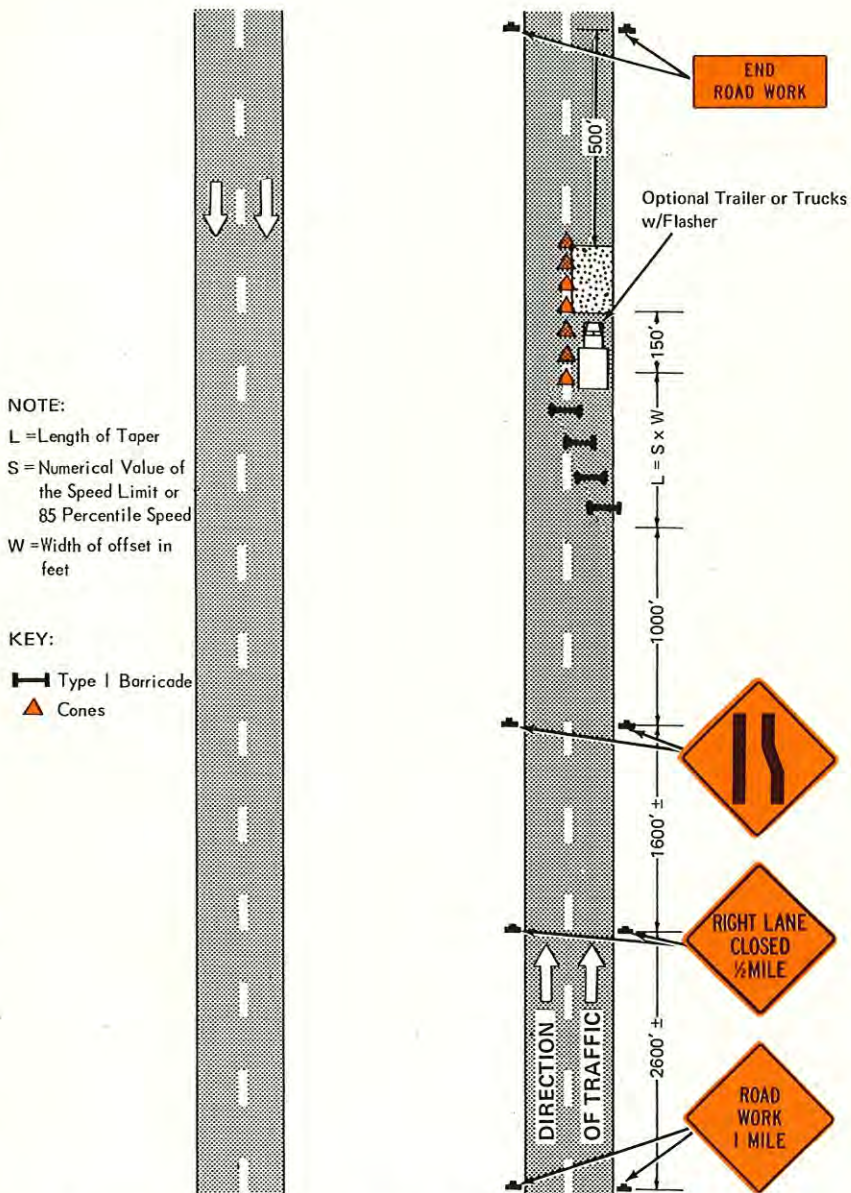


Figure 6-9. Typical application—4-lane divided roadway where half of roadway is closed.

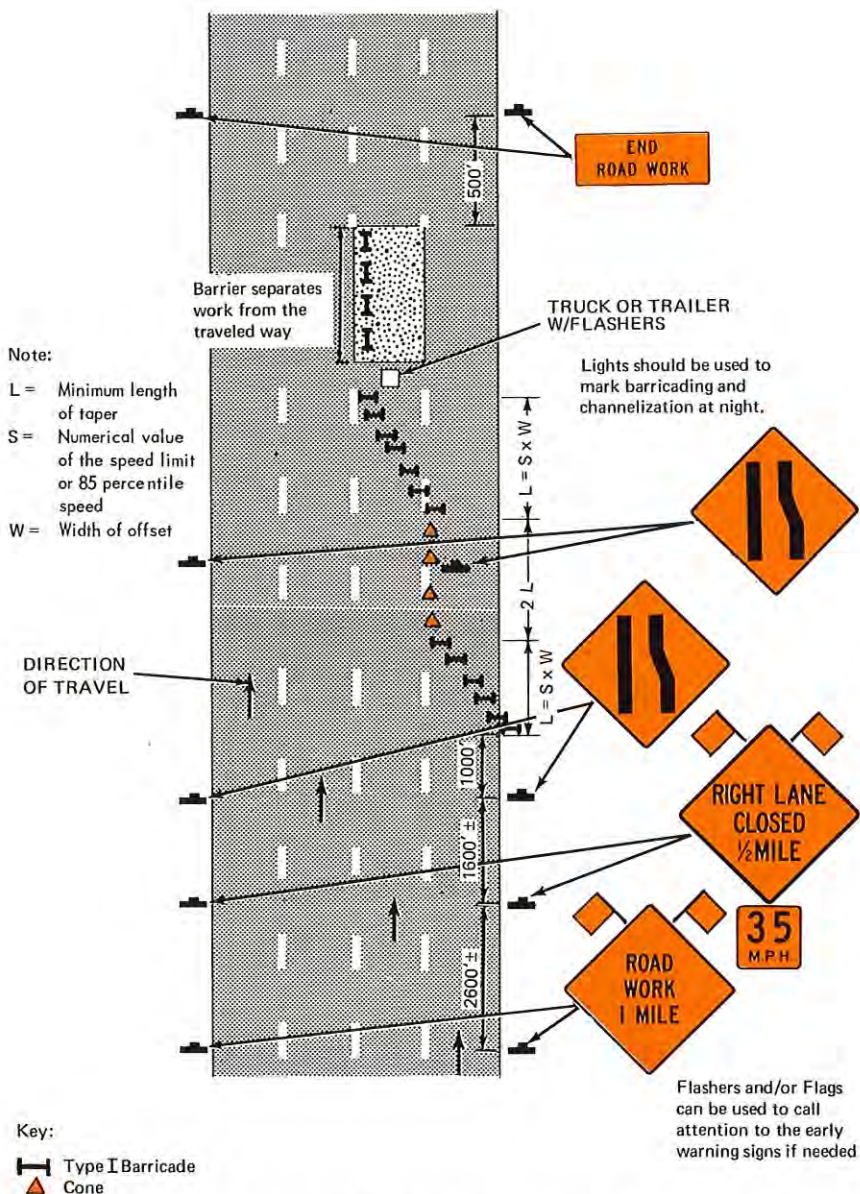
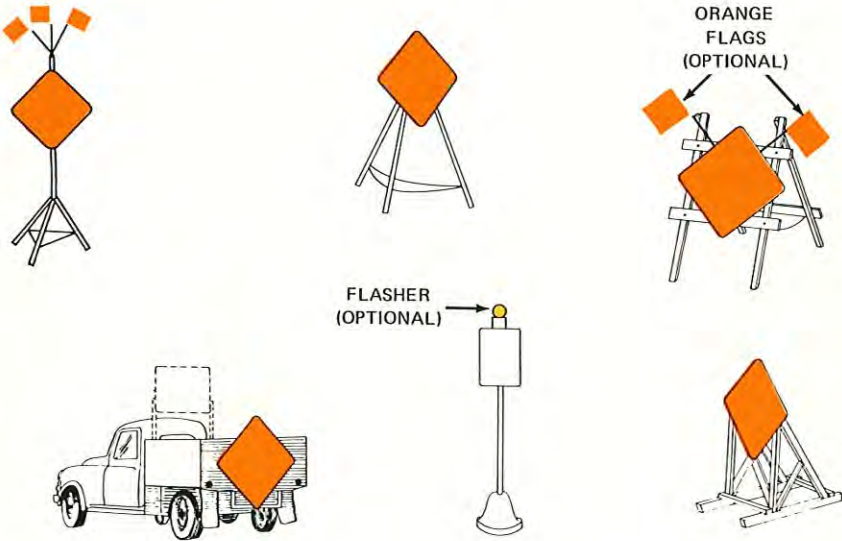


Figure 6-10. Typical application—closing multiple lanes of a multilane highway.

6B-4 Erection of Signs

Signs on fixed supports are usually mounted on a single post, although those wider than 36 inches or larger than 10 square feet in area should generally be mounted on two posts. Signs mounted on portable supports are suitable for temporary conditions. All

PORTABLE AND TEMPORARY MOUNTINGS



WING BARRICADES

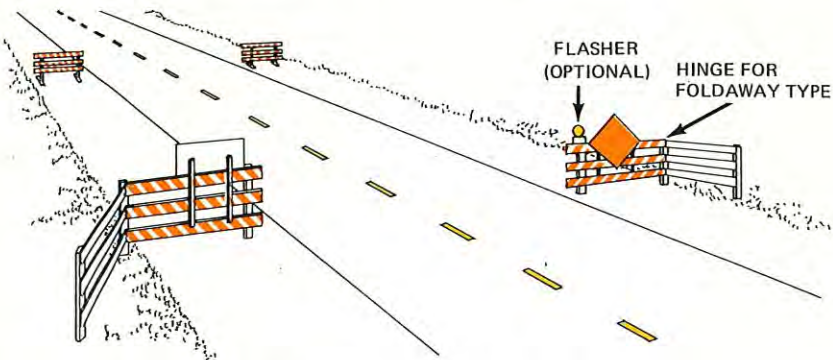


Figure 6-11. Methods of mounting signs other than on posts.

such installations should be so constructed to yield upon impact to minimize hazards to motorists.

For maximum mobility on certain types of maintenance operations, a large sign may be effectively mounted on a vehicle stationed in advance of the work or moving along with it. This may be the working vehicle itself, as in the case of shoulder-mowing or pavement marking equipment, or a vehicle provided expressly for this purpose. These mobile sign displays may be mounted on a trailer, may be provided with self-contained electric power units for flashers and lights, or may be mounted on a regular maintenance vehicle.

Guide signs, although ordinarily erected on separate posts, may also be mounted on or above barricades, but should not be permitted to interfere with the effectiveness of necessary regulatory and warning signs.

Typical methods of mounting signs other than on posts are shown in figure 6-11.

Regulatory Signs

6B-5 Authority

Regulatory signs impose legal obligations and/or restrictions on all traffic. It is essential, therefore, that their use be authorized by the public body or official having jurisdiction and that signs conform with this Manual.

6B-6 Design

Regulatory signs are generally rectangular with their longer dimension vertical, and carry a black legend and border on a white background. The STOP sign is octagonal, and has a white legend and border on a red background. The YIELD sign is a white inverted triangle with red legend and border band. The DO NOT ENTER sign consists of a white square on which is inscribed a red circle with a white band horizontally across the center of the circle and the words DO NOT and ENTER in white letters on the upper and lower parts of the circle. The ONE-WAY sign may be either a horizontal or vertical rectangular plate, the latter being used more commonly in cities where space is limited. Commonly used regulatory signs are illustrated in figure 6-12. Design details for all regulatory signs are given in Part II.

6B-7 Application

Construction and maintenance operations represent unusual roadway conditions and warrant special attention. If construction or



R1-1
30" x 30"



R1-2
36" x 36" x 36"



R5-1
30" x 30"



R5-9
30" x 24"



R2-5a
24" x 30"



R2-5b
24" x 30"



R2-5c
24" x 30"



R2-1
24" x 30"



R8-3
24" x 30"



R6-1
36" x 12"



R6-2
18" x 24"



R4-7
24" x 30"
24" x 18"



R4-1
24" x 30"



R4-2
24" x 30"

Figure 6-12. Commonly used regulatory signs.

maintenance operations require regulatory measures different from those normally in effect, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate temporary regulatory sign, taking into account applicable ordinances or statutes of the jurisdiction involved.

6B-8 Road (Street) Closed Sign (R11-2)

The ROAD (STREET) CLOSED sign shall be used where the roadway is closed to all traffic except contractors' equipment and officially authorized vehicles and shall be accompanied by appropriate detour signing. The sign should be erected at or near the center of the roadway on or above a Type III barricade (sec. 6C-2). Because it is the last sign the driver will see before he must stop or

turn, it is essential that it be large and legible. It shall have a standard, and minimum, size of 48 inches by 30 inches.

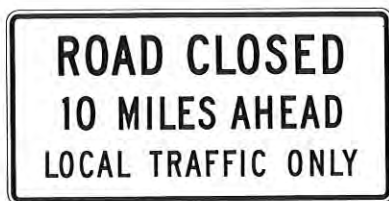
The ROAD (STREET) CLOSED sign shall not be used where traffic is maintained or where the actual closure is some distance beyond the sign and local traffic is permitted access to nearer points. In the latter case the Local Traffic Only sign (sec. 6B-9) should be used.



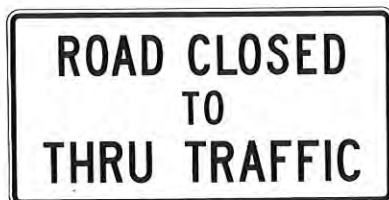
R11-2
48" x 30"

6B-9 Local Traffic Only Signs (R11-3, R11-4)

The Local Traffic Only sign should be used where through traffic must detour to avoid a closing of the road or street some distance beyond, but where the road or street is open for traffic up to the point of closure. It shall carry the legend ROAD CLOSED (10) MILES AHEAD—LOCAL TRAFFIC ONLY or, optionally for urban use, STREET CLOSED TO THRU TRAFFIC and shall be accompanied by appropriate detour signing (fig. 6-4). The words BRIDGE OUT may be substituted for ROAD CLOSED where applicable.



R11-3
60" x 30"



R11-4
60" x 30"

6B-10 Weight Limit Signs (R12-1, R12-2)

For traffic safety in areas of road or street construction and maintenance, a Weight Limit sign shows the gross weight or axle weight

that can be permitted on a roadway surface or bridge. Weight restrictions must be consistent with State or local regulations and shall not be imposed without the approval of the authority having jurisdiction over the highway. When weight restrictions are imposed, a marked detour should be provided for vehicles whose legal weight exceeds the limit posted.



R12-1
24" x 30"



R12-2
24" x 30"

6B-11 Special Regulatory Signs

Various other regulatory signs may be called for by special operations located in or around the roadway. Although it is not practicable to standardize many such signs in detail, they should conform to the general requirements pertaining to color and shape. Their messages should be brief, legible, and clearly understandable.

Warning Signs

6B-12 Function

Warning signs for construction and maintenance projects are used to notify drivers of specific hazards which may be encountered, when those operations are underway. Within the construction zone there may be a variety of temporary roadway facilities. Pavement width may be reduced. Open excavations may be present in or near the roadway, or travel across an unpaved section may be required. Drivers should be properly alerted to possible dangers ahead in sufficient time to adjust their speed for the hazard.

6B-13 Design and Application

Warning signs for construction and maintenance shall be diamond shaped (square with one diagonal vertical), having a black symbol or message on an orange background except as provided for herein.

Construction or maintenance operations on freeway or expressway facilities, may also require large movable warning signs. Mounting considerations for some of these signs may justify a change from the standard diamond shape to a rectangular shape, but such variances should have prior approval of the appropriate highway authority.

The square Advisory Speed plate (sec. 6B-34) shall have a black message and border, and shall have an orange background when used in conjunction with an orange background sign and shall have a yellow background when used with a yellow background sign. It shall have a minimum 24" x 24" size.

Detailed specifications are given only for signs prescribed for construction and maintenance work and for some of the standard signs that are commonly required for these work areas.

On secondary roads or city streets where speeds are low, the use of plates 6 inches smaller on a side than the standard size, but not less than 24 inches, may be used for warning signs having short word messages or clear symbols.

Where distances are to be shown on warning signs as part of the legend, a separate panel with the distance shown thereon may be erected immediately below the sign on the same support.

Where any part of the roadway is obstructed or closed, construction approach warning signs are required to alert traffic well in advance of these obstructions or restrictions to normal traffic flow (sec. 6B-14). These signs may be used singly or in combination. Because of their importance, these signs shall have a standard size of 48 inches by 48 inches and shall be the standard diamond shape for warning signs, except as provided for above.

Where speeds and volumes are relatively low, a minimum size of 36 inches by 36 inches may be used for Construction Approach Warning Signs, provided that a minimum letter size of 5 inches can be accommodated on this size with the appropriate legend.

6B-14 Application of Construction Approach Warning Signs

Various circumstances will occur which will require extra advance warning because of limited sight distance or the nature of the obstruction may require a motorist to bring his vehicle to a stop. Therefore, specified standards or a set sequence of signs are not noted. The determination of the sign or signs to be used shall be on the basis of an engineering study using the following sections as guidelines (secs. 6B-15 to 6B-20). As an alternate to the specific distances on these advance construction signs, the word AHEAD may be used.

6B-15 Advance Road (Street) Construction Sign (W20-1)

The Advance Road (Street) Construction sign shall be located in advance of the initial activity or detour a driver may encounter,

and is intended for use as a general warning of obstructions or restrictions. It carries the legend ROAD (STREET) CONSTRUCTION (1500) FT or ROAD (STREET) CONSTRUCTION (1½) MILE. It may be used in repetition with appropriate legends, or in conjunction with other construction signs.



W20-1
48" x 48"

6B-16 Advance Detour Sign (W20-2)

The Advance Detour sign is intended for use in advance of a point at which traffic is diverted over a temporary roadway or route. It carries the legend DETOUR (1500) FT or DETOUR (1½) MILE. It may be used with repetition with appropriate legends or in conjunction with other construction signs.



W20-2
48" x 48"



W20-3
48" x 48"

6B-17 Advance Road (Street) Closed Sign (W20-3)

The Advance Road (Street) Closed sign is intended for use in advance of a point at which a roadway is closed to all traffic or to

all but local traffic. It carries the legend ROAD (STREET) CLOSED (1000) FT or ROAD (STREET) CLOSED ($\frac{1}{4}$) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

6B-18 Advance One Lane Road Sign (W20-4)

The Advance One Lane Road sign is intended for use only in advance of a point where traffic in both directions must use a single lane (secs. 6E-6 and 7). It carries the legend ONE LANE ROAD (1000) FT or ONE LANE ROAD ($\frac{1}{4}$) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

If the one-lane stretch is of such length as not to be visible throughout from either end, or if the traffic is of such volume that simultaneous arrivals at both ends occur frequently, provision must be made to permit traffic to move alternately under control (secs. 6E-6 to 6E-10).



W20-4
48" x 48"



W20-5
48" x 48"



W20-7
48" x 48"

6B-19 Advance Lane Closed Sign (W20-5)

The Advance Lane Closed sign is intended for use where applicable in advance of a point where one lane of a multiple-lane roadway is closed (sec. 6F-3). It carries the legend RIGHT (LEFT) LANE CLOSED (1000) FT or RIGHT (LEFT) LANE CLOSED ($\frac{1}{4}$) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

6B-20 Advance Flagman Sign (W20-7)

The Advance Flagman sign is intended for use in advance of any point at which a flagman has been stationed to control traffic through a construction or maintenance project. It carries the legend FLAG-

MAN (500) FT or FLAGMAN (1/4) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

The sign shall be promptly removed, covered, or turned to face away from the roadway whenever the flagman is not at his station.

6B-21 Two-Way Traffic Sign(W6-3)

The Two-Way Traffic sign should be used as needed at intervals to periodically remind drivers that they are on a two-way highway which contains opposing traffic.



W6-3
48" x 48"
24" x 18"

6B-22 Application of Maintenance and Minor Construction Warning Signs

At many maintenance and minor construction operations, particularly on lightly traveled roads, there may be no need for the sequence of Construction Approach Warning signs prescribed for major operations. The signs described in the following sections and on figures 6-13a and 6-13b, will ordinarily provide sufficient advance warning in such situations, either by themselves or in combination with appropriate Construction Approach Warning signs, as dictated by conditions. In addition, some of them may be needed inside the limits of a major work area where traffic is maintained through the job.



Figure 6-13a. Warning signs used in construction areas.



W6-1
36" x 36"



Plaque
24" x 18"



W6-2
36" x 36"



Plaque
24" x 18"



W7-1
30" x 30"



Plaque
24" x 18"



W12-1
24" x 24"



W10-1
36" Diameter



W12-2
36" x 36"



Plaque
24" x 18"



W14-3
36" x 48" x 48"

Figure 6-13b. Warning signs used in construction areas.

6B-23 Men Working Sign (W21-1)

The MEN WORKING sign is intended for use in conjunction with minor maintenance and public utility operations for the protection of men working in or near the roadway. On low-speed urban areas the MEN WORKING sign is intended for use at limited obstruction sites which are adequately marked and clearly visible, such as an open manhole with a fence around it.



W21-1
30" x 30"



W21-2
30" x 30"

6B-24 Fresh Oil Sign (W21-2)

The FRESH OIL (TAR) sign is intended for use to warn motorists that resurfacing operations have rendered the surface of the pavement temporarily hazardous, and that objectionable splashing on vehicles may occur.

6B-25 Road Machinery Sign (W21-3)

The ROAD MACHINERY sign is intended for use in areas where heavy equipment is operating in or adjacent to the roadway.



W21-3
36" x 36"



W21-4
36" x 36"

6B-26 Road Work Sign (W21-4)

The ROAD WORK sign is intended for use in advance of maintenance or minor reconstruction operations in the roadway (fig. 6-9).

6B-27 Shoulder Work Sign (W21-5)

The SHOULDER WORK sign is intended for use in advance of maintenance or minor reconstruction operations involving the shoulder, where the traveled way remains unobstructed.



W21-5
30" x 30"



W21-6
30" x 30"

6B-28 Survey Crew Sign (W21-6)

The SURVEY CREW sign is intended for use in advance of a point where a surveying crew is working in or adjacent to the roadway.

6B-29 Signs for Blasting Areas

As sources of radio-frequency (RF) energy can cause the premature firing of electric blasting caps used in construction operations, the public must be warned of such conditions and, as a part of the overall safety precautions, be advised to turn off mobile radio transmitters. From a practical standpoint, however, the possibility of a premature explosion is extremely remote due to the necessary combination of circumstances that is very unlikely to occur in actual practice. There does not appear to be a radio-frequency (RF) initiation hazard in the normal storage and transportation of electric blasting caps as long as they are in their original cartons.

The Institute of Makers of Explosives Publication No. 20, "Radio Frequency Energy, A Potential Hazard in the Use of Electric Blasting Caps," should be consulted for information on this hazard and guidelines for safe operations.¹ This publication provides tables of recommended safe distances which will give the blaster a high degree of assurance that his blasting layout should be safe against radio frequency (RF) initiation.

As a precautionary measure a sequence of signs is recommended for use to remind operators of mobile radio equipment to turn off

¹ Radio Frequency Energy, A Potential Hazard in the Use of Electric Blasting Caps, Publication No. 20, Institute of Makers of Explosives, 420 Lexington Avenue, New York, New York 10017.

transmitters when in a blasting area. The maximum power for amateur radio mobile units being 1000 watts, a minimum safe distance of 1,000 feet is recommended for warning sign placement to satisfy the worst condition. Occasionally, situations may develop where adherence to the 1,000 foot distance or to the tables in Publication No. 20 will create an operational handicap. In these instances it is recommended that competent experts be consulted to evaluate the particular situation.

Recommended practices for warning sign application follow.

6B-30 Blasting Zone Sign (W22-1)

The BLASTING ZONE (1000) FT sign is intended for use in advance of any point or work site where there are explosives being used. The TURN OFF 2-WAY RADIO and END BLASTING ZONE signs must be used in sequence with this sign. Provision shall be made for covering or removing the sign sequence when there are no explosives in the area or the area is otherwise secured.



W22-1
48" x 48"



W22-2
42" x 36"



W22-3
42" x 36"

6B-31 Turn Off 2-Way Radios Sign (W22-2)

The TURN OFF 2-WAY RADIOS sign is to be used in sequence with the BLASTING ZONE (1000) FT and END BLASTING ZONE sign and placed at least 1,000 feet from the beginning of the blasting zone. These signs shall be prominently displayed and covered or removed when there are no explosives in the area or the area is otherwise secured.

6B-32 End Blasting Zone Sign (W22-3)

The END BLASTING ZONE sign is to be used to denote the end of the danger zone and shall be placed a minimum of 1,000 feet from the blasting zone, either with or preceding the END CONSTRUCTION sign.

6B-33 Other Warning Signs

In addition to the warning signs specifically related to construction and maintenance operations there are numerous other warning signs, standardized for general use and treated in Part II of this Manual, that may find application in work areas. These include the following:

1. Large Arrow (W1-6)
2. ROAD NARROWS (W5-1)
3. Divided Highway Ends (W6-2)
4. BUMP (W8-1)
5. DIP (W8-2)
6. PAVEMENT ENDS (W8-3)
7. SOFT SHOULDER (W8-4)
8. TRUCK CROSSING
9. LOOSE GRAVEL
10. ROUGH ROAD
11. LOW SHOULDER

The application of most of these signs is prescribed in detail in Part II of this Manual, although their application is generally apparent from their legends. When used in construction operations, these signs shall have an orange background and when used in highway maintenance operations, they should have an orange background.

6B-34 Advisory Speed Plate (W13-1)

In conjunction with a warning sign, an Advisory Speed plate may be used to indicate a maximum recommended speed through the hazardous area. For use with orange construction and maintenance signs this plate shall have a black legend on an orange background and when used with yellow background warning signs shall have a yellow background.



W13-1
24" x 24"

Except in emergencies, an Advisory Speed plate shall not be erected until the recommended speed has been determined by the authority in charge of the highway.

Guide Signs

6B-35 Function and Design of Information and Guide Signs

The following informational signs are required at construction and maintenance sites:

1. Standard directional signs and route markings, to the extent that temporary route changes are necessary.

2. Special information signs (secs. 6B-36 to 39) relating to the work being done. These signs shall have a black message on an orange background.

6B-36 Length of Construction Sign (G20-1)

The Length of Construction sign shall be erected at the limits of any road construction or maintenance job of more than 2 miles in extent, where traffic is maintained through the job. It carries the legend ROAD CONSTRUCTION (5) MILES. It can be effectively mounted on a wing barricade. This sign may be used where required, for jobs of lesser length or on urban streets with appropriate distances shown.



G20-1
60" x 36"



G20-2
60" x 24"

6B-37 End Construction (Road Work) Sign (G20-2)

The END CONSTRUCTION (ROAD WORK) sign should be erected approximately 500 feet beyond the end of a construction or maintenance job. It may be erected on the back of a warning sign set up facing the opposite direction of traffic or on the back of a wing barricade. Where appropriate, the legend END ROAD WORK may be used.

6B-38 Detour and Detour Arrow Signs (M4-9 and 10)

The Detour Arrow sign (M4-10) is used at a point where a detour roadway or route has been established due to the closure of a street or highway to through traffic. It should normally be mounted just below the ROAD CLOSED sign (sec. 6B-8) or the Local Traffic Only sign (sec. 6B-9).



M4-9R
30" x 24"



M4-10R
48" x 18"

The Detour Arrow sign uses a horizontal arrow pointed to the right or left as required at each location.

Each detour shall be adequately marked with standard temporary route markers and destination signs, as a responsibility of the highway department. If an unmarked street or highway is detoured, the DETOUR sign (M4-9) may be used to indicate the points at which the detour changes direction.

6B-39 Pilot Car Sign (G20-4)

The Pilot Car sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way traffic through or around a road construction or maintenance project (sec. 6E-9). It carries the legend PILOT CAR—FOLLOW ME. A flagman must be stationed on every approach to a project on which a pilot car is used, to hold traffic as necessary until the pilot car is available to lead.



G20-4
36" x 18"

C. BARRICADES AND CHANNELIZING DEVICES**6C-1 Function**

The functions of barricades and channelizing devices are to warn and alert drivers of hazards created by construction or maintenance activities in or near the traveled way, and to guide and direct drivers safely past the hazards.

In fulfilling these two functions, barricades and channelizing devices are often required to satisfy two opposing requirements. For example, a channelization installation should be constructed in a substantial manner to provide protection for men working in the roadway. At the same time, however, the channelization devices should provide a smooth and gradual transition which reduces the width of the traveled way, and in this case the channelizing devices should not inflict any severe damage to a vehicle that inadvertently strikes them. The objective should be the development of a traffic control plan which uses a variety of traffic control measures in whatever combination necessary to assure smooth, safe vehicular movement past the work area and at the same time provides maximum safety for the equipment and the workmen on the job.

Barricades and channelizing devices are elements in a total system of traffic control devices for use in highway construction and maintenance operations, and these elements shall be preceded by a subsystem of warning devices that are adequate in size, number and placement for the type of highway on which the work is to take place.

6C-2 Barricade Design

Barricades shall be one of three types: Type I, Type II and Type III. The characteristics of these types are shown in table VI-1 and figure 6-14.

Markings for barricade rails shall be either alternate orange and white or black and white stripes (sloping downward at an angle of 45 degrees in the direction traffic is to pass). The orange and white and white and black markings shall not be intermixed in the same installation or area.

Where a barricade extends entirely across a roadway, it is desirable that the stripes slope downward in the direction toward which traffic must turn in detouring. Where both right and left turns are provided for, the chevron striping may slope downward in both directions from the center of the barricade.

The entire area of white and orange stripes shall be reflectorized so as to be visible under normal atmospheric conditions from a minimum distance of 1,000 feet when illuminated by the low beams of standard automobile headlights. The predominant color for other barricade components shall be white.

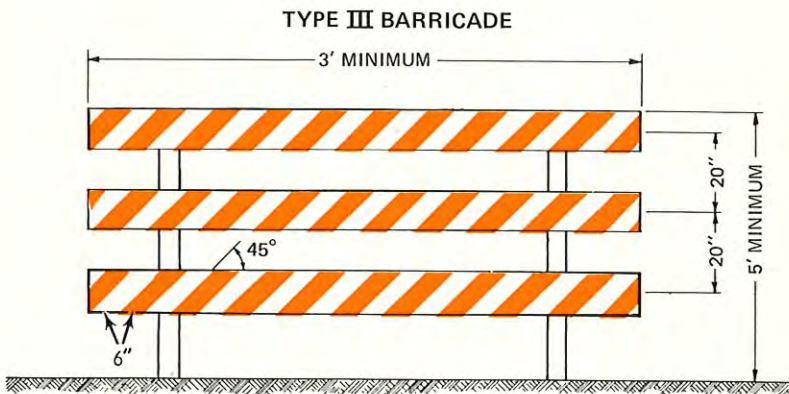
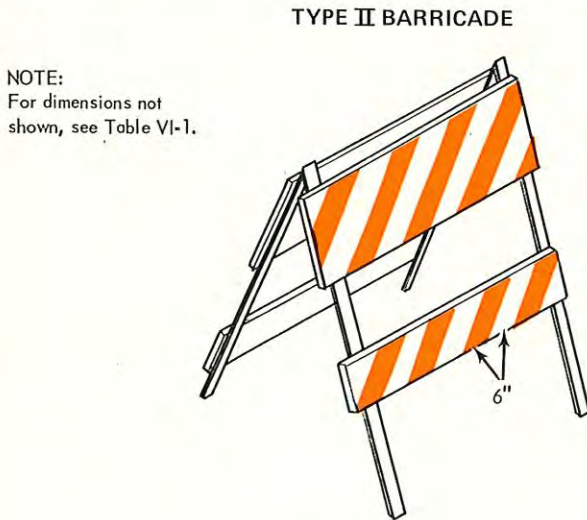
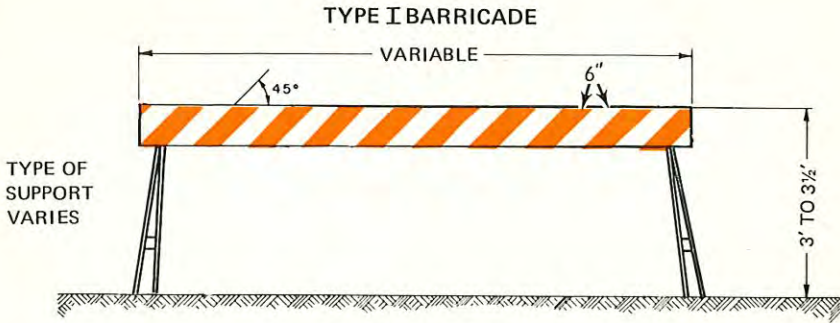


Figure 6-14. Standard barricades.

TABLE VI-1 Barricades—Characteristics

Type			
	I	II	III
Width of Rail	8" min—12" max	8" min—12" max	8" min—12" max
Length of Rail	6'—8'	3' min—4' max	3' min—variable max
Width of Stripes	6 in.	6 in.	6 in.
Height	3 ft. min	3 ft. min	5 ft. min
Type of Frame	Demountable or Heavy "A" Frame	Light "A" Frame	Post or Skids
Flexibility	Essentially movable	Portable	Essentially permanent

6C-3 Cone Design

Traffic cones and tubular markers of various configurations are available. These shall be a minimum of 18 inches in height with a broadened base and may be made of various materials to withstand impact without damage to themselves or to vehicles. Larger size cones should be used where speeds are relatively high or wherever more conspicuous guidance is needed. Orange shall be the predominant color on cones. They should be kept clean and bright for maximum target value. For nighttime use they shall be reflectorized or equipped with lighting devices for maximum visibility.

6C-4 Drum Design

Drums are normally metal drums, of 30 to 55 gallon capacity, set on end and used as an expedient method for traffic channelization. The color and marking of drums shall be consistent with marking standards for barricades, orange and white or black and white. These colors shall not be intermixed in the same area. The predominant color on drums shall be black or orange with at least two horizontal, circumferential white stripes 4 to 6 inches wide (fig. 6-15). Drums shall be reflectorized for use at night and should never be placed in the roadway without advance warning signs. In addition, a flashing warning light should be added when drums are used singly, and steady warning lights when they are used in a series for channelization (sec. 6D-3).

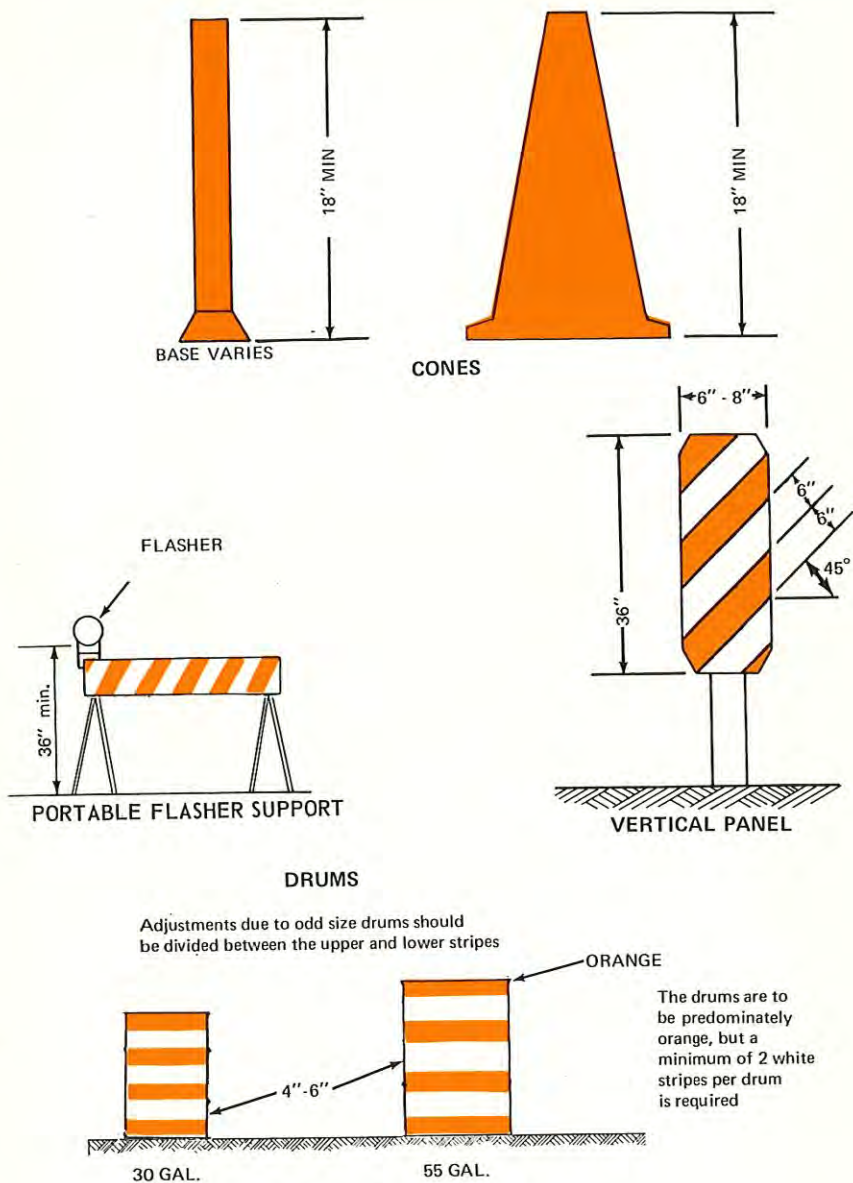


Figure 6-15. Channelizing devices.

6C-5 Vertical Panel Design

Vertical panels used as channelizing devices shall consist of at least one panel 6 to 8 inches in width and 24 inches in height. They shall be striped and reflectorized in the same manner as barricades and mounted with the top a minimum of 36 inches above the road-

way on a single lightweight post. The optional orange and white or black and white design shall not be intermixed in the same area. These devices may be used for traffic separation or shoulder barricading where space is at a minimum.

6C-6 Barricade Construction

Typical examples of barricade construction are shown in figures 6-11 and 14.

The horizontal members of Type I barricades shall be 8 to 12 inches wide. The supports for the rail may be fabricated of lumber, metal or other suitable material, properly shaped. In either case the support should contain, at the prescribed height, a notch or loop into which the horizontal members may be inserted. The essential element of this feature is to permit rapid assembly and disassembly of the barricade for movable situations. This barricade is normally used in 6 to 8 foot lengths.

Type II barricades may be constructed of wooden, metal or other components, or combinations thereof. The supports should be of an "A" frame configuration or hinged or otherwise fastened at the top to permit convenient folding and stacking for transporting from one work site to another. Since portability is a prime consideration, the materials chosen for the barricades should be as light weight as possible commensurate with structural soundness. Irrespective of the materials used for constructing Type II barricades, they have a relatively high center of gravity and are, therefore, susceptible to overturning in the wind. Sandbags should be used for ballasting when required.

Since Type III barricades are somewhat permanent in nature and are required to function in one location for a relatively long time, they should be substantially constructed. When the barricades are constructed on bases instead of posts set into the ground, it may be desirable to ballast the bases with sand bags to provide added resistance to overturning during periods of high winds.

6C-7 Barricade Application

On construction projects, when a road section is closed to traffic, Type III barricades shall be erected at the points of closure. They may extend completely across a roadway and its shoulders (as a fence) or from curb to curb. Where provision must be made for access of equipment and authorized vehicles, the Type III barricades should be provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where access is provided through the Type III barricades, responsibility should be assigned to a person to assure proper closure at the end of each working day.

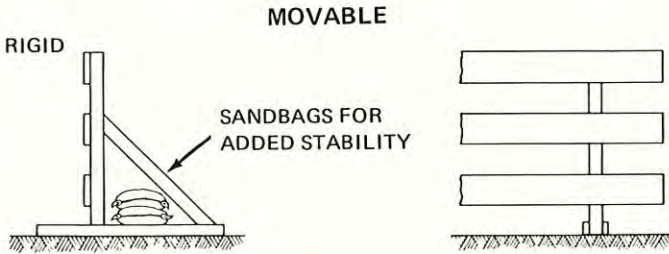
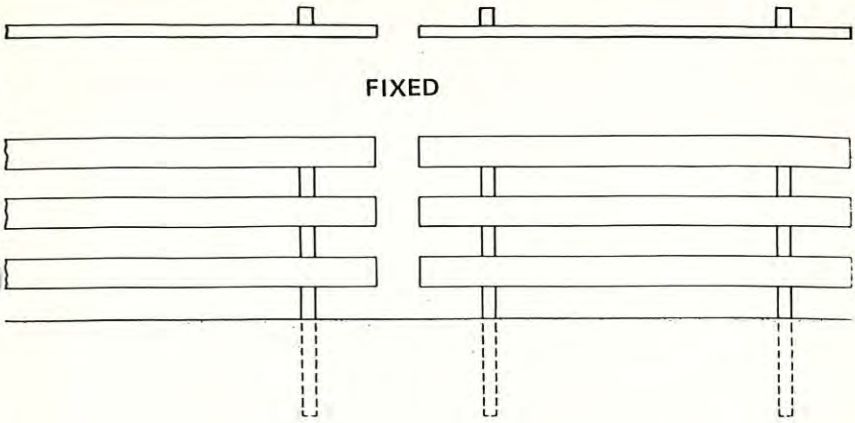


Figure 6-16. Type III barricade construction—typical examples.

When a road or street is legally closed, but access must still be allowed for local traffic, the Type III barricade cannot be erected completely across a roadway. Instead, an arrangement should be devised that will permit local use but effectively discourage use by through traffic. A sign with the appropriate legend concerning permissible use by local traffic should be installed.

Applications of this principle are illustrated in figures 6-3 and 6-4.

Type I or Type II barricades shall be used when traffic is maintained through the area being constructed and/or reconstructed. The important characteristic of these barricades is that each is movable, and they may be used interchangeably. In general, Type I barricades are the heavier and more bulky of the two, but these factors are dependent in large part, on the materials from which each type is constructed.

The ultimate choice in a given situation would probably be dependent upon the degree of mobility required in the particular project. It should be kept in mind, however, that Type I and Type II barricades, although movable, are somewhat clumsy and are not as adaptable to changeable situations as traffic cones.

Where maintenance activities are being performed, a street or highway condition is seldom of a character that will require a complete closing of the facility. When such a condition does occur, it is almost always an emergency situation, as would result from a broken water main or a washed-out culvert, for example. Repair work is generally initiated on an emergency basis and the street or road closing generally is of a kind wherein Type I or Type II is utilized.

Wing barricades are a special application of Type III barricades, erected on the roadway shoulder (on one or both sides of the pavement) to give the illusion of a narrowed or restricted roadway. In advance of a construction or maintenance area, even where no part of the roadway is actually closed, wing barricades serve a useful purpose in alerting the driver. If used in a series, they should start at the outer edge of the shoulder and be brought progressively closer to the pavement. Wing barricades may be used as a mounting for the advance warning or guide signs or lighting devices. During periods of inactivity, a foldaway type of design may be advantageous. Examples of wing barricades are shown in figure 6-11.

Signs may be erected on barricades, particularly those of the fixed type, and they offer a most advantageous facility for this purpose. The ROAD CLOSED and Detour Arrow signs, and the Large Arrow warning signs, for example, can effectively be mounted above the barricade that closes the roadway.

6C-8 Barrel or Drum Application

Barrels or drums are an effective traffic control device, particularly for use in construction areas.

One effective application is to delineate an unusual vehicle path made necessary by the construction activity. Another effective application occurs on road widening projects, where a row of barrels is used at night to mark the edge of pavement and channelize traffic away from an open trench alongside the pavement. During working hours, the same barrels are moved onto the pavement to provide working room for the construction activity and smoothly channelize traffic around the work area.

Barrels or drums are bulky and not readily transportable, but they are highly visible and have good target value. They give the appearance of being formidable obstacles and, therefore, command the respect of drivers, yet they do not inflict undue damage to a vehicle in the event they are struck. Finally, the barrels are portable enough to be shifted from place to place within a construction project in order to accommodate changing conditions as construction progresses. Barrels should not be weighted with sand, water or any material to the extent that would make them hazardous to motorists. As an effective channelizing method, barrels or drums may be used to support conventional guardrail sections.

For routine maintenance activities, barrels or drums are seldom used because of their bulk and relative lack of portability. Where maintenance forces undertake work such as pavement replacement, however, barrels or drums may be included among the traffic control devices used. Their application should be as described above for construction projects.

6C-9 Traffic Cone Application

Included under this heading are a group of devices whose primary function is the channelization of traffic. They may be conical in shape, but there are also tubular shaped devices available capable of performing the same function. They may be set on the surface of the roadway or rigidly attached for continued use.

Traffic cones may be easily stacked on a truck and one workman can carry and distribute several cones with ease. This mobility and flexibility (which cannot be equalled by Type I barricades) increases the usefulness of these devices.

When cones are used, precautions are necessary to assure they will not be blown over or displaced. This may be particularly critical adjacent to lanes of moving traffic where there may be a wind created by passing vehicles. Some cones are constructed with bases that

may be filled with ballast. With others, it may be necessary to double the cones in order to provide added weight, or to construct weights such as a square of reinforcing rod, that can be dropped over the cone and onto the base to provide increased stability. These added weights should not be sufficient to present a hazard if the devices are inadvertently struck.

In general, traffic cones have a greater target value than do the tubular shaped devices. However, the target value of either device may be enhanced during the day time by the insertion of an orange flag in the top and at night, by the insertion of appropriate colored delineators in the tops or by use of internal lights.

6C-10 Delineator Application

As used herein, delineators mean all types of reflector units that are capable of reflecting light from either the upper or lower beam of automobile headlamps. Their usefulness in construction and maintenance zones is one of guidance rather than one of warning. Delineators properly installed will indicate the horizontal and vertical alignment of the roadway and thereby outline the required vehicle path through what otherwise might be a confusing alignment caused by construction or maintenance activities in the roadway. Delineators shall be spaced sufficiently close, to clearly outline the intended vehicle path during hours of darkness.

Delineator applications in construction or maintenance areas, would almost always be made in combination with some of the other traffic control devices discussed in the preceding paragraphs.

6C-11 Pavement Markings Application

When construction work necessitates the utilization of vehicle paths other than the lanes normally used (as indicated by existing pavement markings), daytime and nighttime drive-through checks should be made to evaluate the path (and the possibility that the pavement markings will inadvertently lead drivers into barricades and/or work sites). Where necessary these markings should be obliterated or removed.

Where stage construction requires changes in barricades or channelization, similar day-night checks and evaluations of the existing pavement marking should accompany each change.

When a temporary roadway is constructed to by-pass a closed portion of highway, appropriate reflectorized pavement markings shall be placed on the approach to, and throughout the length of, the temporary roadway. At locations where the duration of the temporary roadway is relatively short, pavement markings consist-

ing of reflectorized paint lines may not be practical due to the time required and expense involved in their removal.

Under the above conditions, adequate short term expendable pavement markings can be provided by use of pressure sensitive traffic marking tape or raised pavement markers. Either of these types of devices can be applied simply and quickly and can be removed with little or no difficulty when changing traffic patterns makes the installation obsolete.

Temporary pavement markings shall be used in combination with appropriate warning signs, channelizing devices and delineation to clearly indicate the required vehicle paths.

Where maintenance activities are being performed, the use of pavement markings generally has little application. Maintenance work performed on the roadway is usually accomplished during normal daytime working hours with the work site being protected by an adequate complement of warning signs and channelizing devices to indicate the proper vehicle path. However, on longtime maintenance jobs, such as the removal and replacement of a portion of a bridge deck, the existing pavement marking may be a significant item to be considered in the traffic control plan to be employed. The application of pavement markings should then be as discussed above for construction projects.

6C-12 Channelization

The single most important element, within the system of traffic control devices commonly used in construction or maintenance areas (where a reduction in pavement width is involved), is the taper that is provided for the channelization. An inadequate taper will almost always produce undesirable traffic operations with resulting congestion and possibly accidents through the area.

A minimum desirable taper rate expressed as length in feet per foot of offset and numerically equal to the 85 percentile speed is essential for smooth traffic operations. For example, if a lane is to be closed on a roadway with an existing 60 MPH 85 percentile speed, the channelization to accomplish the transition should be placed on a 60:1 taper.

The minimum desirable length derived from the rate indicated above applies to roadway conditions of relatively flat grades and straight alignment. Adjustments may become necessary to provide adequate sight distance on the approach to the channelization. Similarly, the proximity of interchange ramps, crossroads, etc., to the work site may dictate the need for adjustments. In general, better traffic operations will result when the adjustments consist of increasing the length of the taper rather than reducing the length (below the minimum desirable recommended above).

The real test concerning adequate length of taper is the operation of vehicles through the transition. It should be long enough so that drivers of vehicles approaching side by side have sufficient length in which to adjust their respective speeds and merge into a single lane before the end of the transition. A brief period of observing driver performance will generally provide some clear indications of the adequacy of the taper length. For example, if severe brake applications are observed, an increased taper length is indicated.

On construction projects channelization often remains in the same place for long periods of time. During such a long interval some of the elements—cones, barricades, barrels, etc.—get out of their original alignment due to being struck, moved due to construction activities, etc. It is necessary, therefore, to patrol the channelization at regular intervals to assure its proper functioning as a traffic control device. Replacement or shifting of the elements into the original alignment can best be done if the original positions of the elements had been indicated on the pavement by paint marks. This technique assures good alignment and proper vehicle performance over a long period of time with minimum expenditure of men and materials in maintaining the channelization.

Sometimes during maintenance operations, work at one site will extend over several days, thereby requiring that channelization be set up each morning and removed each evening. Under these circumstances the locations of the cones, barrels, etc., should be marked at the time of the original set-up to facilitate the rapid, orderly re-setting of the devices on each succeeding day.

D. LIGHTING DEVICES

6D-1 Function

Construction and maintenance activities often create conditions on or near the traveled way that are particularly hazardous at night when the ability of drivers to see is sharply reduced from daytime conditions. It is often desirable and necessary to supplement the reflectorized signs, barriers and channelizing devices with lighting devices that are described in the following paragraphs.

Three types of electric lights are commonly used: floodlights, steady burning lights, and flashing lights.

6D-2 Floodlights

On construction projects, floodlights have a limited, but important application. Sometimes large construction contracts are prosecuted on a double shift basis, particularly earth moving activities. Oftentimes, the earth moving involves a haul road crossing a public high-

way, at which point a flagman station is generally set up. In order to assure the safest possible conditions at this type of location, it is advisable to supplement the warning devices (used in advance of the crossing) with floodlighting of the flagman station and the crossing site. Care is required in order to adequately illuminate the desired area without creating glare in the eyes of drivers on the highway. The adequacy of the floodlight placement can best be determined by driving through and observing the floodlighted area from each direction on the highway.

Maintenance activities on urban freeways, with high volume, high density traffic conditions, are frequently required to be conducted during nighttime periods (with low traffic volumes). Good floodlighting of the work site is a necessity because the workmen need to see what they are doing and because the workmen and the work site need to be seen by passing drivers. The lighting units should be positioned so they do not cause glare to drivers on the highway.

6D-3 Hazard Identification Beacons (Flashing Electric Lights)

A Hazard Identification Beacon is a flashing yellow signal light (minimum diameter 8 inches) used at points of special hazard as a means of calling drivers' attention to these locations. When used, the flashing beacon should operate 24 hours a day.

On construction projects, because of the time and effort required to install and put these units into operation, they are used, generally, only at locations where frequent changes would not be required.

On projects where an existing dual highway is being upgraded to freeway standards (which requires the use of crossovers to permit stage construction) flashing beacons have been used effectively to call drivers' attention to the hazard created by the necessary channelizing devices. Similarly, the temporary terminus of a freeway (where all traffic is channelized into an exit) is a location where beacons have informed drivers of the speed reduction necessary in transitioning from freeway to local road operations.

Hazard Identification Beacons may be operated singly or in groups containing more than one Unit.

During normal daytime maintenance operations, the functions of flashing beacons are adequately provided for by the lighting equipment on maintenance vehicles, either the emergency flashers, the rotating dome light, or both. However, at locations where the daytime maintenance activity requires an obstruction to remain in the roadway at night, flashing beacons may be installed at the point of hazard. At locations where vandalism is no problem, the power may be provided by a portable electric generator.

6D-4 Steady Burning Electric Lamps

As used herein, steady burning electric lamps shall mean a series of low wattage yellow electric lamps. They may be used to mark obstructions or hazards, but they are generally less effective than flashing lights for these uses because of the attention getting effect of the latter. However, where lights are needed to delineate the traveled way through and around obstructions in a construction or maintenance area, the delineation shall be accomplished by use of steady burning lamps.

Steady burning lamps, placed in a line on longitudinal barricades, have been effective in delineating the proper vehicle path through stage construction areas (which require changing patterns of traffic movement).

The application of these devices during maintenance activities is infrequent due to the generally short time nature of maintenance work. A type of maintenance activity where steady burning lamps could be utilized is the removal and replacement of a portion of a bridge deck. The lamps could be mounted on barricades and effectively aid in channelizing traffic around the work area.

6D-5 Barricade Warning Lights

As used herein, Barricade Warning Lights are portable, lens directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady burn or flashing mode. Barricade warning lights shall be in accordance with the requirements of ITE Standard for Flashing and Steady Burn Barricade Warning Lights (1971) (table VI-2).

Table VI-2
Barricade Warning Lights

	Type A <i>Low Intensity</i>	Type B <i>High Intensity</i>	Type C <i>Steady Burn</i>
Lens Directional Faces	1 or 2	1	1 or 2
Flash Rate per Minute	55 to 75	55 to 75	Constant
Flash Duration ¹	10%	8%	Constant
Minimum Effective Intensity ²	4.0 Candelas	35 Candelas	
Minimum Beam Candle Power ²			2 Candles
Hours of Operation	Dusk to Dawn	24 hrs/day	Dusk to Dawn

¹ Length of time that instantaneous intensity is equal to or greater than effective intensity.

² These values must be maintained within an elliptical pattern 9° on each side of the vertical axis, and 5° above and 5° below the horizontal axis.

Type A Low Intensity Flashing Warning lights are most commonly mounted on separate portable supports, on Type I or Type II barricades, or on vertical channelizing devices, and are intended to continually warn the driver that he is proceeding in a hazardous area.

Type B High Intensity Flashing Warning lights are normally mounted on the advance warning signs or on independent supports. Extremely hazardous site conditions within the construction area may require that the lights be mounted on Type I barricades, signs, or other supports. As these lights are effective in daylight as well as dark, they are designed to operate 24 hours per day.

Type C Steady Burn lights are intended to be used to delineate the edge of the traveled way on detour curves, on lane changes, on lane closures and on other similar conditions. Their application shall be as indicated in section 6D-4.

The light weight and portability of barricade warning lights are advantages that make these devices useful as supplements to the reflectorization on hazard warning devices. The flashing lights are effective in attracting a driver's attention and, therefore, provide an excellent means of identifying the hazard. Flashers shall not be used for delineation, as a series of flashers would tend to obscure the desired vehicle path.

Portable supports for barricade warning lights shall provide a minimum mounting height of 36 inches to the bottom of the lens (fig. 6-15). These stands are not intended for use as standard barricades.

6D-6 Special Lighting Units

Special lighting units, generally trailer-mounted for easy transport to a job site, have been developed to supplement conventional signs, pavement markings and lighting for maintenance activities. The flashing lights on the unit are operated from a self-contained power source mounted on the trailer, either batteries or an electric generator. A variety of light configurations are used for traffic warning and guidance. Most units are designed with racks, channels or other devices so that signs may be displayed with messages appropriate to the particular kind of work being performed.

These special lighting units are used most frequently on high density urban freeways and are placed just in advance of the work site. The flashing lights, together with appropriate signs, have proven to be very effective warning devices while also providing some physical protection to the maintenance men at work.

Although these special lighting units were developed to satisfy a need on urban freeways, they have many applications on all types

of highways. Their mobility, together with the availability of flashing lights and/or a variety of sign messages makes them useful for almost any situation where conditions require extraordinary advance warning of the maintenance activities. If the units are to be used at night, consideration should be given to providing a means whereby the intensity of the flashers may be reduced during darkness when the lower intensities are desirable.

6D-7 Lanterns or Torches

As used in this Manual, lanterns and torches are single-unit, portable, constant-burning, low-intensity types of lights with open or enclosed flame. They provide negligible illumination of other objects, and are not altogether dependable under adverse weather conditions such as high wind or heavy rain. Furthermore, the flammable fuel used in the lanterns or torches may be a hazard to life and property, and their use, therefore, is not recommended, except in the special circumstances described below.

Open flame torches may have an application in rural areas where under nighttime conditions, they might be the only device available to a maintenance man to put into immediate use, in the event of an emergency. However, even under these conditions, the torches should be replaced as quickly as possible with more effective devices that have been discussed in the previous sections.

E. CONTROL OF TRAFFIC THROUGH WORK AREAS

6E-1 Function

The primary function of traffic control procedures is to move traffic safely and expeditiously through or around work areas.

The control of traffic through work areas is an essential part of highway construction and maintenance operations. For these operations there must be adequate legislative authority for the implementation and enforcement of needed traffic regulations, parking controls and speed zoning. Such statutes must provide sufficient flexibility in the application of traffic control to meet the needs of the changing conditions in work areas.

Maintaining good public relations is necessary. The cooperation of the various news media in publicizing the existence of and reasons for work sites, therefore can be of great assistance in keeping the motoring public well informed.

6E-2 Hand Signaling Devices

A number of hand signaling devices, such as red flags, STOP/SLOW paddles and lights are used in controlling traffic through

work areas. The flag is the most common device used during the daylight hours. The sign paddle bearing the clear messages STOP or SLOW also may be used.

Flags used for signaling purposes shall be a minimum of 24 by 24 inches in size, made of a good grade of red material securely fastened to a staff approximately 3 feet in length. The free edge should be weighted to insure that the flag will hang vertically, even in heavy winds.

Sign paddles should be at least 24 inches wide, with 6 inch series C letters. A rigid handle should be provided. This combination sign may be fabricated from sheet metal or other light semirigid material. The background of the STOP face shall be red with white letters and border. The background of the SLOW shall be orange with black letters and border. When used at night the STOP face shall be reflectorized red with white reflectorized letters and border, and the SLOW face shall be reflectorized orange with black letters and border.

6E-3 Flagmen

Since flagmen are responsible for human safety and make the greatest number of public contacts of all construction personnel, it is important that qualified personnel be selected. A flagman should possess the following minimum qualifications:

1. Average intelligence.
2. Good physical condition, including sight and hearing.
3. Mental alertness.
4. Courteous but firm manner.
5. Neat appearance.
6. Sense of responsibility for safety of public and crew.

The use of an orange vest, and/or an orange cap shall be required for flagmen. For nighttime conditions similar outside garments shall be reflectorized.

Flagmen are provided at work sites to stop traffic intermittently as necessitated by work progress or to maintain continuous traffic past a work site at reduced speeds to help protect the work crew. For both of these functions the flagman must, at all times, be clearly visible to approaching traffic for a distance sufficient to permit proper response by the motorist to the flagging instructions, and to permit traffic to reduce speed before entering the work site. In positioning flagmen, consideration must be given to maintaining color contrast between the flagman's protective garments and his background.

6E-4 Flagging Procedures

The following methods of signaling with a flag should be used :

1. *To Stop Traffic.* The flagman shall face traffic and extend the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. For greater emphasis, the free arm may be raised with the palm toward approaching traffic.

FLAG



TO STOP
TRAFFIC

PADDLE



TRAFFIC
PROCEED



TO ALERT
AND SLOW
TRAFFIC



Figure 6-17. Use of hand signaling devices by flagman.

2. *When it is Safe for Traffic to Proceed.* The flagman shall stand parallel to the traffic movement, and with flag and arm lowered from view of the driver, motion traffic ahead with his free arm. Flags shall not be used to signal traffic to proceed.

3. *Where it is Desired to Alert or Slow Traffic.* By means of flagging, the flagman shall face traffic and wave the flag in a sweeping motion of the arm across the front of the body without raising the arm above a horizontal position.

If a sign paddle is used, it shall be held in a stationary position with the arm extended horizontally away from the body. The use of the flag and sign paddle are illustrated in figure 6-17.

Lights approved by the appropriate highway authority or reflectorized sign paddles or reflectorized flags shall be used to flag traffic at night. Daytime flagging procedures shall be followed whenever such lights, paddles or flags are used at night.

Whenever practicable, the flagman should advise the motorist of the reason for the delay and the approximate period that traffic will be halted. Flagmen and operators of construction machinery or trucks should be made to understand that every reasonable effort must be made to allow the driving public the right-of-way and prevent excessive delays.

6E-5 Flagman Stations

Flagman stations shall be located far enough in advance of the work site so that approaching traffic will have sufficient distance to reduce speed before entering the project. This distance is related to approach speed and physical conditions at the site; however, 200 to 300 feet is desirable. In urban areas when speeds are low and streets closely spaced, the distance necessarily must be decreased.

The flagman should stand either on the shoulder adjacent to the traffic he is controlling or in the barricaded lane. At a "spot" obstruction he may have to stand on the shoulder opposite the barricaded section to operate effectively. Under no circumstances should he stand in the lane being used by moving traffic. He should be clearly visible to approaching traffic at all times. For this reason he should stand alone, never permitting a group of workmen to congregate around him. He should be stationed sufficiently in advance of the work force to warn them of approaching danger, such as out-of-control vehicles.

Flagman stations should be adequately protected and preceded by proper advance warning signs. At night, flagman stations should be adequately illuminated.

6E-6 One-Way Traffic Control

Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement to pass traffic through the constricted section. At a "spot" obstruction, such as an isolated pavement patch, the movement may be self-regulating. However, where the one-lane section is of any length, there should be some means of coordinating movements at each end so that vehicles are not simultaneously moving in opposite directions in the section and so that delays are not excessive at either end. Control points at each end of the route should be chosen so as to permit easy passing of opposing lines of vehicles.

Alternate one-way traffic control may be effected by the following means:

1. Flagman control.
2. Flag-carrying or official car.
3. Pilot car.
4. Traffic signals.

6E-7 Flagman Control

Where the one-lane section is short enough so that each end is visible from the other end, traffic may be controlled by means of a flagman at each end of the section. One of the two should be designated as the chief flagman for purposes of coordinating movement. They should be able to communicate with each other verbally or by means of signals. These signals should not be such as to be mistaken for flagging signals.

Where the end of a one-lane section is not visible from the other end, the flagmen may maintain contact by means of radio or field telephones. So that a flagman may know when to allow traffic to proceed into the section, the last vehicle from the opposite direction can be identified by description or license.

6E-8 Flag-Carrying or Official Car

Flag carrying is effective when the route is well defined and non-hazardous. It should be employed only when the one-way traffic is confined to a relatively short stretch of road, usually not more than 1 mile in length.

The driver of the last vehicle proceeding into the one-lane section is given a red flag (or other token) and instructed to deliver it to the flagman at the other end. The opposite flagman, upon receipt of the flag, then knows that it is safe to allow traffic to move in the other direction. The flag being carried should always be clean and dry.

A variation of this method is the use of an "official" car which always follows the last vehicle proceeding through the section. The use of an official car eliminates the possibility of loss of the flag.

6E-9 Pilot Car

The use of a pilot car for traffic control can be most effective where the route is particularly hazardous, or so involved or frequently altered as to preclude adequate signing. The pilot car is used to guide a train of vehicles through the job or detour. Its operation must be coordinated with flagging operations or other controls at each end of the one-lane section. Sufficient turnaround room should be provided at these points. Provision should be made for identification of the last vehicle in the column.

The vehicle selected for pilot-car study should be light weight and easy to handle and should have the name of the contractor or contracting authority prominently displayed. The Pilot Car sign (sec. 6B-39) shall be mounted on the rear of the vehicle.

Two or more pilot cars may be used to guide two-way traffic through a particularly complex or hazardous detour.

6E-10 Traffic Control Signals

Traffic control signals may be used for special applications to control vehicular traffic movements at construction or maintenance work areas.

Typical applications include:

1. A highway or street intersection with a temporary "haul road" or equipment crossing.
2. Through areas requiring one-way traffic operations..

All traffic signal and control equipment shall meet the applicable standards and specifications prescribed in Part IV of this Manual. Normally, these installations shall be operated by means of traffic actuation or manual control.

One-way traffic operation necessitates the use of an all-red interval of sufficient duration for traffic to clear the zone at the speed posted through the work area.

F. EXPRESSWAYS AND LIMITED ACCESS FACILITIES

6F-1 Application of Standards

Serious problems of traffic control occur under the special conditions encountered where traffic must be moved through or around maintenance or construction operations on high-speed, high-volume facilities. Although the general principles outlined in the previous

sections of the Manual are applicable to all types of highway facilities, special consideration must be given to the modern, high-speed and usually limited access-type of highway to accommodate traffic in a safe and efficient manner and for adequate protection of work forces. The density of traffic on these facilities requires that traffic control procedures be implemented, for example, to permit critical merging maneuvers to occur well in advance of work areas and in a manner which creates minimum turbulence in the traffic stream. These situations may require a much higher type of device than specified for normal rural or urban street use. The same important basic considerations of uniformity and standardization of general principles apply, however, for all facilities.

6F-2 Problem Areas

The conduct of maintenance and construction operations under high-speed, high-density traffic on controlled-access highways is complicated by many of the design and operational features inherent in their use.

The presence of median dividers on many facilities which establish separate roadways for directional traffic also may prohibit the closing of that roadway for maintenance operations or the diverting of traffic to other lanes.

Lack of access to and from adjacent facilities prohibits rerouting of traffic away from work areas in many cases.

A major consideration in the establishment of traffic controls is the vehicular speed differential which exists and the limited time for drivers to safely react to unusual conditions.

In many cases, the year-round night and day intensity of use of expressways and limited-access facilities means that there is no season during which maintenance work can be scheduled when traffic volumes and density are low. Instead, these activities must be performed under extremely hazardous conditions.

Other conditions exist where work must be limited to night hours necessitating increased use of warning lights and illumination for work areas and advance warning systems.

The following sections emphasize some of the special considerations which must be applied in the application of devices for control of traffic, considering the above conditions.

6F-3 Signs

The messages of most of the standard warning signs described previously are applicable; however, signs larger than 48" x 48" may be desirable or required for additional emphasis. For large signs,

a rectangular shape may be justified with approval of the appropriate highway authority. Movable signs mounted on trucks or trailers with specially constructed lighting units provide a means of giving additional advance warning to motorists. Requirements may exist for placing advance signs at $\frac{1}{2}$, 1, or even 2 miles from the work site to inform traffic of possible delays before they reach exits that might lead to alternate routes and where traffic might be expected to back up past conventional warning signs placed at the work site. It is also desirable to place additional advance warning on adjacent facilities whenever entrances to the limited-access facility are past the usual warning signs.

A complete series of warning signs is generally required on both sides of the roadway for lane closures or other restrictions to traffic flow which may be encountered. The sign layout should provide the driver with specific information on the lane closed; for example, type of activity or event, speed controls, and special directions for passing around or through the work site. The reasonableness of all restrictions must be carefully evaluated to obtain maximum driver observance.

All supports for signing should be installed with breakaway or yielding features for motorists safety.

A variety of information and guide signs may be needed on the approach to work sites for various purposes in addition to the hazard warning signs.

6F-4 Barricades and Channelization

The direction of freeway-type traffic through or around work sites requires the use of prominently positioned barricades and delineation devices for establishing tapers for lane closures or other situations where traffic must divert from its normal path. The success or failure of a lane closure will often depend upon the ability of traffic in a closed lane to merge with the adjacent lane. In practice this merge does not usually take place until the taper barricades, cones or other devices are encountered. For this reason the taper length must be sufficiently long to give drivers every opportunity to find an acceptable gap in the adjacent lane before having to slow down or stop and impede other traffic. Under relatively normal conditions of speed and volume, and where adequate warning of a lane obstruction has been provided, the taper rate described in section 6C-12 should be sufficient. However, this length should be adjusted as required by traffic operations.

Because of space and other limitations, cones may have greater use than barricades for transition sections. For night use, illumination may be required in addition to reflectorization of all devices in the transition section.

6F-5 Lighting Devices

The general principles used for daytime freeway traffic controls are equally applicable at night. However, the need for adequate lighting devices is essential on high-speed facilities to maintain safe traffic flow. The addition of flashing lights to all advance warning signs and the complete illumination of night work areas should be considered.

6F-6 Control of Traffic

On freeway-type facilities, the objective of traffic control in maintenance and construction areas is to allow a free flow of traffic by keeping the maximum number of lanes open to traffic at all times. The use of traffic control signs should be discouraged. Additional police patrols and officers assigned to the work site to keep traffic flowing will minimize delays. During peak hour conditions or when congestion develops, it may be necessary to delay work progress until traffic is moving freely. An emergency traffic operation plan should be developed for alternate routing of traffic in the event of a complete closure of one or more segments of the highway. Predetermined routes should be employed to divert excess traffic around the obstructions by intercepting traffic at some earlier point on the roadway. A specially equipped traffic control vehicle housing a complete set of traffic control signs and devices as well as vehicle-mounted signs and lights should be available, as required.

Invaluable assistance to the traffic control on major facilities can be provided through advance use of the public information media. Radio and television announcements, newspaper notices, road condition reports and maps and ramp hand-outs can be effectively utilized to inform the public of anticipated delays or congestion resulting from necessary maintenance and construction activities.

These practices should complement the on-site traffic control procedures and the preplanning which is essential for effective operations.

Personnel used for work on controlled-access facilities should receive formal training in traffic control, in the conduct of work at these locations and in the importance of keeping traffic moving through and around maintenance and construction sites.

Part VII. TRAFFIC CONTROLS FOR SCHOOL AREAS

A. GENERAL

7A-1 Need for Standards

Traffic control in school areas is a highly sensitive subject. If all the demands of parents and others were met, there would have to be many more police and adult guards for school duty; and many more traffic signals, signs, and markings. Such demands, however, are not always in line with actual needs.

Analyses often show that at many locations, school crossing controls requested by parents, teachers and other citizens are unnecessary and costly and tend to lessen the respect for controls that are warranted. It is therefore important to stress the point that regardless of the school location, safe and effective traffic control can best be obtained through the uniform application of realistic policies, practices and standards developed through engineering studies.

Pedestrian safety depends in large measure upon public understanding of accepted methods for efficient traffic control. This principle is never more important than in the control of pedestrians and vehicles in the vicinity of schools. Neither school children nor motorists can be expected to move safely in school zones unless they understand both the need for traffic controls and the ways in which these controls function for their benefit.

Non-uniform procedures and devices cause confusion among pedestrians and motorists, prompt wrong decisions, and can contribute to accidents. In order to achieve uniformity of traffic control in school areas, comparable traffic situations must be treated in the same manner. Each traffic control device and control method described in this part fulfills a specific function related to specific traffic conditions.

The type of school area traffic control used, either warning or regulatory, must be related to the volume and speed of traffic, street width and the number of children crossing. For this reason, the traffic controls necessary in a school area located on a major highway would not be needed on a residential street away from heavy traffic. Yet, the important point to be made is that a uniform approach to school area traffic controls must be developed to assure the use of similar controls for similar situations (which promotes uniform behavior on the part of motorists and pedestrians).

A school route plan for each school serving elementary and kindergarten students is useful in developing uniformity in the use of school area traffic controls. The plan, developed by the school and traffic officials responsible for school pedestrian safety, consists of a simple map showing streets, the school, existing traffic controls, established school routes, and established school crossings. A typical school route plan map is shown in figure 7-1.

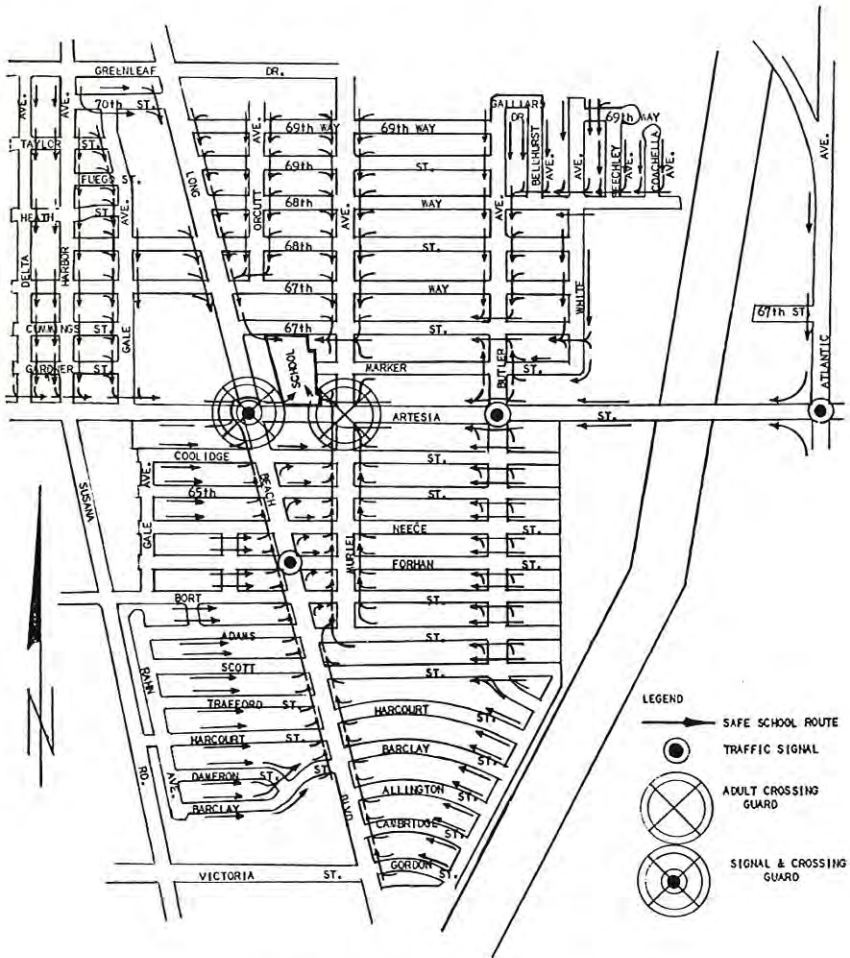


Figure 7-1. Typical school route plan map.

The plan permits the orderly review of school area traffic control needs, and the coordination of school pedestrian safety education and engineering activities.

The following treatment of signs, signals, and markings for school areas is intended to provide in effect a comprehensive handbook in

its field, to be applied as a national standard. It establishes general principles to be observed in designing, installing, and maintaining traffic control devices in school areas, and prescribes specific standards where possible. While it constitutes a part of this Manual, it is designed so that it can be used independently, for the convenience of those who are not concerned with the many other phases of traffic control. To that end some material concerning specifications and devices having more general application is repeated here from preceding parts of this Manual.

Reference to reduced speed signs for school areas and crossings is included in this Manual solely for the purpose of standardizing signing for these zones.

However, this is not to be considered an endorsement of the practice of mandatory reduced speed zones for all school areas and crossings.

7A-2 School Routes and Established School Crossings

School routes should be planned to take advantage of the protection afforded by existing traffic controls. This planning criterion may make it necessary for children to walk a non-direct, longer distance to an established school crossing located where there is existing traffic control, and to avoid the use of a direct, hazardous crossing where there is no existing traffic control.

Factors to be considered when determining the feasibility of requiring children to walk a longer distance to a crossing (at a location with existing traffic control) are:

1. The availability of adequate, safe sidewalks or off roadway sidewalk areas to and from the location with existing control,
2. The number of children using the crossing,
3. The age levels of the children using the crossing, and
4. The total extra walking distance.

7A-3 School Crossing Control Criteria

Alternate gaps and blockades are formed in the vehicular traffic stream in a pattern peculiar to each crossing location. For safety, a pedestrian must wait for a gap in traffic that is of sufficient duration to permit a street crossing without interference from vehicular traffic. When the delay (between the occurrence of adequate gaps) becomes excessive, children may become impatient and endanger themselves by attempting to cross the street during an inadequate gap. This delay may be considered excessive, when the number of adequate gaps in the traffic stream, during the period the children are using a crossing, is less than the number of minutes in that same

time period. With this condition (when adequate gaps occur less frequently than an average of one per minute) some form of traffic control is needed which will create (in the traffic stream) the gaps necessary to reduce the hazard.

A recommended practice for determining the frequency and adequacy of gaps in the vehicular traffic stream is given in the Institute of Traffic Engineers publication, *A Program for School Crossing Protection*.¹

7A-4 Scope

This part sets forth basic principles and prescribes standards to be followed in the design, application, installation and maintenance of all traffic control devices and other controls required for the special pedestrian conditions of school areas. Such devices and controls include signs, signals, markings, adult guards, student patrols, and grade separated crossings.

7A-5 Application of Standards

The standards of this Manual apply to all streets and highways regardless of type or the level of governmental agency having jurisdiction.

All traffic control devices used in school areas shall conform to the applicable specifications of this Manual.

7A-6 Engineering Study Required

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not meant to be a substitute for engineering judgment. It is the intent that the provisions of this Manual define the standards for traffic control devices, but shall not be a legal requirement for their installation.

7A-7 Maintenance of Traffic Control Devices

Maintenance of devices must be to high standards to assure that legibility is retained, that the device is visible, that it is functioning properly, and that it is removed if no longer needed.

Special care shall be taken to see that devices in use on a part-time basis are in operation only during the time periods they are required.

Regulatory traffic control devices for school areas should be removed, covered or not operated when they are not needed for extended periods of time, such as during summer vacations.

¹A Program for School Crossing Protection, Revised 1971, Institute of Traffic Engineers, 2029 K Street, N.W., Washington, D.C. 20006.

7A-8 Legal Authority

Traffic control devices shall be placed only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic control device or its support shall bear any advertising or commercial message, or any other message that is not essential to traffic control.

7A-9 Removal of Confusing Advertising

There should be legal authority to prohibit the display of any unauthorized sign, signal, marking, or device which interferes with the effectiveness of any official traffic control device. The enactment of Section 11-205 of the Uniform Vehicle Code will provide this authority.

7A-10 Meanings of "Shall," "Should" and "May"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall," "should" and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual in the use of these words, the following definitions are given:

1. **SHALL**—A mandatory condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory that these requirements be met.

2. **SHOULD**—An advisory condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.

3. **MAY**—A permissive condition. No requirement for design or application is intended.

B. SIGNS

7B-1 Design of Signs

Uniformity in design includes shape, color, dimensions, symbols, wording, lettering, and illumination or reflectorization. The U.S. Department of Transportation, Federal Highway Administration, on request, will furnish (to State and local highway and traffic authorities, sign manufacturers, and similarly interested agencies) detailed drawings of the standard signs illustrated in this Manual. Standardization of these signs does not preclude further improvement by minor changes in the proportion of symbols, stroke width and height of letters, or width of borders. However, all shapes and colors shall be as indicated, all symbols shall be unmistakably similar to those shown and (where a word message is applicable) the wording shall be as provided herein.

Illustrations for new symbol signs include an educational plaque (that may be used with the new symbol sign). These plaques are intended for use during the period necessary for public education. Their inclusion is in recognition that these sign symbols represent a change of considerable magnitude. The intent is that an orderly transition to a consistent symbol system is desirable and that agencies should proceed toward this goal as rapidly as public acceptance and other considerations permit.

In the specifications here given for individual signs, the legend, color, and size are shown in the accompanying illustration and are not always detailed in the text.

7B-2 Dimensions

The sign dimensions prescribed in this Manual shall be standard for application on public highways. An increase above these standard sizes is desirable where greater legibility or emphasis is needed.

7B-3 Lettering

Sign lettering shall be in upper-case letters of the type approved by the National Joint Committee on Uniform Traffic Control Devices and its sponsoring agencies.

7B-4 Sign Borders

All signs illustrated herein have a border of the same color as the legend, at or just inside the edge. When a border is darker than the background, it should be set in from the edge. When the border is lighter, it should extend to the edge of the plate.

7B-5 Illumination and Reflectorization

Ordinarily the signs used for school area traffic control need not be reflectorized or illuminated, but if there is a considerable use of school buildings by children during hours of darkness, it may be desirable to give the signs in the vicinity of the school adequate nighttime visibility.

7B-6 Position of Signs

Signs should be placed in positions where they will convey their messages most effectively without restricting lateral clearance or sight distances. Placement therefore should be accommodated to highway design, alignment and roadside development. Signs should have a maximum practical lateral clearance from the edge of the traveled way for safety of vehicles that may leave the roadway and strike the sign supports. Normally signs should not be closer than 6 feet from the edge of a paved shoulder, or if none, 12 feet from the edge of the traveled way.

In urban areas, if the lateral clearances indicated in the preceding paragraph are not practicable, a lesser clearance may be used (not less than 2 feet from the face of a curb). In urban areas, where sidewalk width is limited or existing poles are close to the curb, a clearance of 1 foot from the curb face is permissible.

Portable school signs shall not be placed within the roadway at any time.

7B-7 Height of Signs

Signs erected at the side of the road in rural districts shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the level of the roadway edge. In business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet.

7B-8 Erection of Signs

Normally signs should be mounted approximately at right angles to the direction of, and facing, the traffic that they are intended to serve.

7B-9 School Advance Sign (S1-1)

The School Advance sign is intended for use in advance of locations where school buildings or grounds are adjacent to the highway. It may also be used in advance of established school crossings not adjacent to a school ground.

Where used, the sign generally shall be erected not less than 150 feet nor more than 700 feet in advance of the school grounds or school crossing. The sign shall have a minimum height and width of 36 inches.



S1-1
36" x 36"



S2-1
36" x 36"

7B-10 School Crossing Sign (S2-1)

The School Crossing sign is intended for use at established crossings including signalized locations used by pupils going to and from

school, except that at crossings controlled by stop signs, the sign should be omitted. Only crossings adjacent to schools and those on established school pedestrian routes shall be signed. When used, the sign shall be erected at the crosswalk, or at the minimum distance possible in advance of the crosswalk, and shall be a minimum 36" x 36" size.

A School Advance sign (sec. 7B-9) shall be used in advance of the School Crossing sign.

7B-11 School Bus Stop Ahead Sign (S3-1)

The School Bus Stop Ahead sign is intended for use in advance of locations where a school bus, when stopped to pick up or discharge passengers, is not visible for a distance of 500 feet in advance. It shall have a minimum 30" x 30" size.

It is not intended that these signs be used wherever a school bus stops to pick up or discharge passengers. These signs are intended for use only where terrain and roadway features limit the approach sight distance and where there is no opportunity to relocate the stop to another location with adequate visibility.

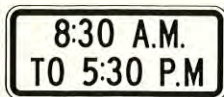


S3-1
30" x 30"

7B-12 School Speed Limit Signs (S4-1, S4-2, S4-3, S4-4)

The School Speed Limit sign shall be used to indicate the speed limit where a reduced speed zone for a school area has been established (in accordance with law, after an engineering and traffic investigation) or when a speed limit is specified for such areas by statute. The sign shall be either a fixed-message sign assembly or a variable display type sign.

The fixed message sign assembly shall consist of a top panel (S4-3), 24" x 8" (the legend SCHOOL in black on a yellow background), a Speed Limit sign (R2-1), 24" x 30", and a bottom panel (S4-1) indicating the specific period or periods of the day and/or days of the week, when the special school speed limit applies. The bottom panel shall be 24" x 10" (or larger if needed) and shall have a black legend on a white background. Alternate legends such as



S4-1
24" x 10"



S4-2
24" x 10"



S4-3
24" x 8"



S4-4
24" x 10"

WHEN CHILDREN ARE PRESENT (S4-2) may be used if permitted by law. The numerical speed limit displayed on the sign shall be the limit established by law.

Variable display signs may be used to indicate the special school speed limit. These signs may use blank-out messages or other methods to display the school speed limit only during the periods it applies. A Speed Limit Sign Beacon may also be used, with a WHEN FLASHING sign (S4-4), to identify the periods the school speed limit is in force.

Because of special features, it may not always be practical to make variable display signs conform in all respects to the accepted stand-



School Speed Limit
Sign Assembly



Possible Sign
With Speed Limit
Sign Beacon

ards. However, during the periods the school speed limit is in force, their basic shape, message, legend layout, and colors should conform to the standard for the fixed message sign, except that if the sign is internally illuminated, it may have a white legend on a black background.

Variable display signs with flashing beacons should be used for the more critical situations, where greater emphasis of the special school speed limit is needed.

Where practical, consideration should be given to including, on the back of variable display signs, a light or device to indicate the speed limit message is in operation or visible.

At the end of an authorized and posted school speed zone, the speed limit for the following section of highway should be posted with a standard Speed Limit sign.

7B-13 Parking and Stopping Signs (R7 Series)

Parking signs and other signs governing the stopping and standing of vehicles in school areas cover a very wide variety of regulations and only general specifications can be laid down here. Typical examples are as follows:

1. No Parking 8:00 AM to 5:00 PM School Days Only
2. No Stopping 8:00 AM to 5:00 PM School Days Only
3. 5 Min. Loading 8:00 AM to 5:00 PM School Days Only

The legend on parking signs shall state whatever regulations apply, but the signs shall conform to the standards of shape, color, position and use. Generally, parking signs should display such of the following information as is appropriate, from top to bottom of the sign, in the order listed:

1. Restriction or prohibition.
2. Time of day it is applicable, if not at all hours.
3. Days of week applicable, if not every day.

In addition, there should be a single-headed arrow pointing in the direction the regulation is in effect (if the sign is at the end of a zone) or a double-headed arrow pointing both ways (if the sign is at an intermediate point in a zone). As an alternate to the arrow (if the signs are posted facing traffic at an angle of 90 degrees to the curb line) there may be included on the sign, or on a separate plate below the sign, such legend as **HERE TO CORNER, HERE TO ALLEY, THIS SIDE OF SIGN, or BETWEEN SIGNS.**

Where parking is prohibited at all times or at specified times, parking signs shall have red letters and border on a white background (Parking Prohibition signs); and where only limited-time parking is permitted, or where parking is permitted only in a par-

ticular manner, the signs shall have green letters and border (Parking Restriction signs).

For emphasis the word NO or the numeral showing the time limit in hours or minutes may be in a reversed color arrangement in the upper left-hand corner of the sign, i.e., in white on a rectangular area of red or green.

Parking signs shall have a standard size of 12 inches by 18 inches. If arrows are used to indicate the extent of the restricted zone, the signs should be set at an angle of not less than 30 degrees nor more than 45 degrees with the line of traffic flow to be visible to approaching traffic. If word legends on a separate panel are used to indicate the extent of the restricted zone, the signs should be posted facing traffic at an angle of 90 degrees to the curb line.

C. MARKINGS

7C-1 Functions and Limitations of Markings

Markings have definite and important functions to perform in a proper scheme of school area traffic control. In some cases they are used to supplement the regulations or warnings of other devices such as traffic signs. In other instances they obtain results, solely on their own merits, that cannot be obtained by the use of any other device. In such cases they serve as a very effective means of conveying certain regulations and warnings that could not otherwise be made clearly understandable.

Pavement markings have definite limitations. They are obliterated by snow, may not be clearly visible when wet, and may not be very durable when subjected to heavy traffic. In spite of these limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the driver without diverting his attention from the roadway.

7C-2 Standardization

Each standard marking shall be used only to convey the meaning prescribed for it in this Manual.

7C-3 Crosswalk Lines

Crosswalk lines shall be solid white lines marking both edges of the crosswalk. They shall be not less than 6 inches in width and should not be spaced less than 6 feet apart. Under special circumstances (where no advance stop line is provided or where vehicular speeds exceed 35 MPH or where crosswalks are unexpected) it may be desirable to increase the width of the crosswalk line up to 24"

in width. Crosswalk lines on both sides of the crosswalk should extend across the full width of pavement to discourage diagonal walking between crosswalks.

Crosswalks should be marked at all intersections on established routes to school where there is material conflict between vehicles and kindergarten or elementary students (while crossing), where students are permitted to cross between intersections, or where students could not otherwise recognize the proper place to cross.

For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45° angle or with white longitudinal lines at a 90° angle to the line of the crosswalk. These lines should be approximately 12'' to 24'' wide and spaced 12'' to 24'' apart. When diagonal or longitudinal lines are used to mark a crosswalk, the transverse crosswalk lines may be omitted. Care should be taken to insure that crosswalks with diagonal or longitudinal lines used at some locations do not weaken or detract from other crosswalks (where special emphasis markings are not used).

7C-4 Stop Lines

Stop lines are solid white lines, normally 12 to 24 inches wide, extending across all approach lanes, and (under both urban and rural conditions) indicate the point at which vehicles are required to stop in compliance with a stop sign, traffic signal, officer's direction, or other legal requirement. When used, the stop line should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line.

7C-5 Curb Markings for Parking Restrictions

Since curb markings of yellow and white are used for delineation and visibility, it is usually advisable to establish parking regulations through the installation of standard signs. However, when local authorities prescribe special colors for curb markings as supplemental to standard signs, they may be used.

When signs are not used, intended meaning should be stenciled on the curb.

Signs shall always be used with curb markings in those areas where curb markings are frequently obliterated by accumulations of snow and ice.

7C-6 Word and Symbol Markings

Word and symbol markings on the pavement may be used for the purpose of guiding, warning, or regulating traffic. They should be limited to not more than a total of three lines of words and/or symbols. They shall be white in color.

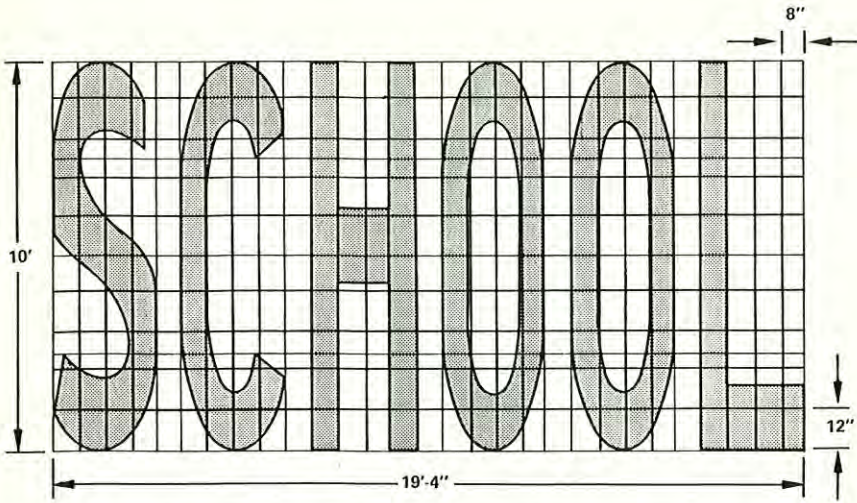


Figure 7-2. Two-lane pavement marking—detail of word “SCHOOL”.

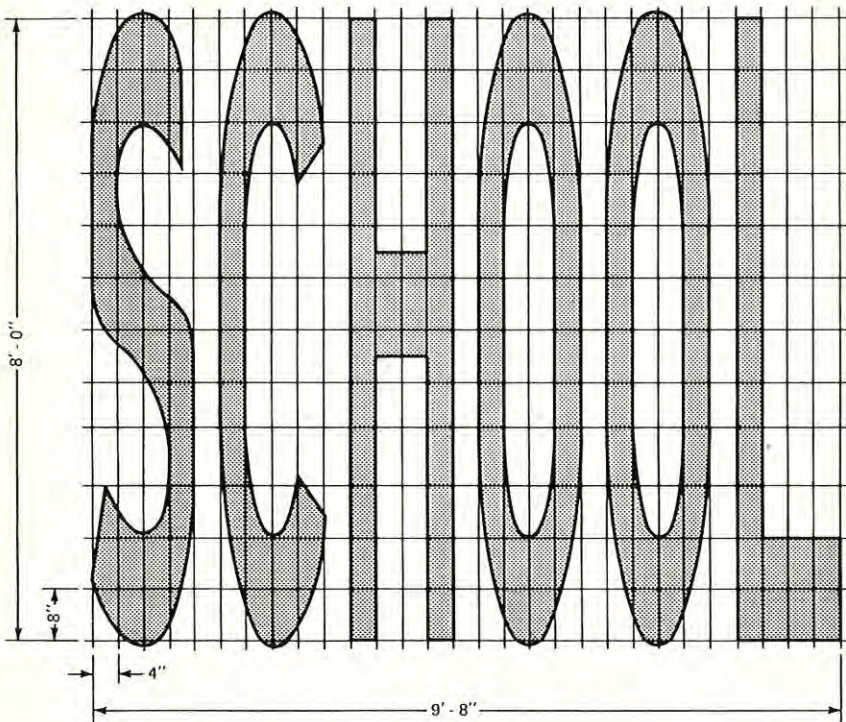


Figure 7-3. Single-lane pavement marking—detail of word "SCHOOL".

Word and symbol markings shall not be used for mandatory messages except in support of standard signs.

The letters and symbols should be greatly elongated in the direction of traffic movement because of the low angle at which they are viewed by approaching drivers. Large letters, symbols and numerals should be used, 8 feet or more in height; and, if the message consists of more than one word, it should read "up" i.e., the first word should be nearest to the driver. Where approach speeds are low, somewhat smaller characters may be used. The space between lines should be at least four times the height of the characters for low speed roads but not more than ten times the height of the characters under any conditions. Recommended designs of elongated letters for the word SCHOOL are shown in figures 7-2 and 7-3.

D. SCHOOL AREA TRAFFIC SIGNALS

7D-1 Definition

School signals are standard traffic control signals erected at established school crossings on the basis of a need to create adequate gaps in the vehicular traffic stream for pedestrian crossings.

7D-2 Advantages and Disadvantages

When properly designed, located and operated under conditions that fully warrant their use, school signals usually have either or both of the following advantages:

1. Considering initial and operating costs, school signals over a period of several years represent an economy as compared with police supervision or crossing guards.
2. Under conditions of favorable spacing they can be coordinated with adjacent signals to provide for continuous or nearly continuous movement of vehicular traffic.

Properly designed and warranted signals also have some disadvantages and the following should be considered when choosing a specific means of crossing control:

1. School signal control has a much higher initial cost than police supervision or crossing guards. It should not be considered for locations where several years use cannot be expected.
2. In some circumstances, the school signal control requires supplemental control by an adult guard or school safety patrol.
3. If school signal control is to be properly operated, provision must be made for both periodic and emergency maintenance by capable, trained persons.

7D-3 Standardization

Because of the great mobility of today's traffic and the ever-increasing range of traffic circulation, it is of primary importance that there be national standardization of those features of traffic signals that affect public participation in traffic movement. This applies without exception to signals at school crossings (where instant recognition and understanding of controls is vital to both students and motorists). Deviations and innovations in school areas, however well-accepted by local people, are bound to lead to confusion and disobedience on the part of strangers.

Design, application, location, and operation lend themselves to a certain degree of standardization, and standards for such features are prescribed herein. A driver or pedestrian must first see signals and then react to their indications. Location and sequence of operation are basic requirements. Signals should be placed where a driver or pedestrian cannot miss seeing them. Standard signal indications and sequences should be used universally so that a signal message can be recognized and heeded at a glance.

7D-4 Warrants

A school signal may be warranted at an established school crossing when a traffic engineering study (of pedestrian group size and available gaps in the vehicular traffic stream) indicates that the number of adequate gaps in the traffic stream during the period the children are using the crossing, is less than the number of minutes in that same time period (sec. 7A-3).

When traffic control signals are installed solely under this warrant:

1. Pedestrian indications shall be provided at least for each crosswalk established as a school crossing.
2. At an intersection, the signal normally should be traffic actuated. Intersection installations that can be fitted into progressive systems may use pretimed control.
3. At non-intersection crossings, the signal should be pedestrian actuated, parking and other obstructions to view should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new non-intersection location.

A School Advance sign (sec. 7B-9) and a School Crossing sign (sec. 7B-10) may be used at locations where signals are installed under this warrant.

7D-5 Meaning of Signal Indications

In Part IV of this Manual meanings and applications for all traffic signal color and arrow indications are given. In this section the meanings are given only for the signal indications generally used at school crossings and the flashing yellow when a speed limit sign beacon is used as part of a variable display School Speed Limit sign assembly (sec. 7B-12).

The CIRCULAR GREEN indication and the GREEN ARROW indication shall have the following meanings:²

1. Traffic, except pedestrians, facing a CIRCULAR GREEN signal may proceed straight through or turn right or left unless a sign at such place prohibits either such turn. But vehicular traffic, including vehicles turning right or left, shall yield the right-of-way to other vehicles and to pedestrians lawfully within the intersection or an adjacent crosswalk at the time such signal is exhibited.

2. Traffic, except pedestrians, facing a GREEN ARROW signal, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

3. Unless otherwise directed by a pedestrian signal, pedestrians facing any green signal, except when the sole green signal is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.

The steady CIRCULAR YELLOW and YELLOW ARROW shall have the following meanings:³

1. Traffic, except pedestrians, facing a steady CIRCULAR YELLOW or YELLOW ARROW signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter when vehicular traffic shall not enter the intersection.

2. Pedestrians facing a steady CIRCULAR YELLOW or YELLOW ARROW signal, unless otherwise directed by a pedestrian signal, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.

The steady CIRCULAR RED or RED ARROW shall have the following meanings:⁴

1. Traffic, except pedestrians, facing a steady circular red signal alone shall stop at a clearly marked stop line, but if none, before

² Section 11-202, Uniform Vehicle Code, Revised 1968.

³ Ibid.

⁴ Ibid.

entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown except as provided in 2. below.

2. When a sign is in place permitting a turn, traffic, except pedestrians, facing a steady CIRCULAR RED signal may cautiously enter the intersection to make the turn indicated by such sign after stopping as required by subsection 1. above. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

3. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady CIRCULAR RED signal alone shall not enter the roadway.

4. Traffic, except pedestrians, facing a steady RED ARROW indication may not enter the intersection to make the movement indicated by such arrow, and unless entering the intersection to make such other movement as is permitted by other indications shown at the same time, shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to make the movement indicated by such arrow is shown.

5. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady RED ARROW signal indication shall not enter the roadway.

Pedestrian signal indications shall have the following meanings:⁵

1. The DONT WALK indication, steadily illuminated, means that a pedestrian shall not enter the roadway in the direction of the indication.

2. The DONT WALK indication, while flashing, means that a pedestrian shall not start to cross the roadway in the direction of the indication, but that any pedestrian who has partly completed his crossing during the steady WALK indication shall proceed to a sidewalk, or to a safety island.

3. The WALK indication, steadily illuminated, means that pedestrians facing the signal indication may proceed across the roadway in the direction of the indication.

4. The WALK indication, while flashing, means that there is a possible conflict of pedestrians with vehicles.

The flashing CIRCULAR YELLOW indication, displayed as a Speed Limit Sign Beacon, shall mean that the school speed limit shown on the sign is in effect.

⁵ Section 11-203, op cit.

7D-6 Intersection and Non-Intersection Installations

School signals may be installed at established school crossings at intersection and non-intersection locations under the adequate gap warrant.

Intersection locations have the hazards of turning vehicles and generally require the provision of signal equipment for the control of vehicle traffic on two streets. However, they are less likely to present an element of surprise for drivers, and they may provide a secondary function of improved vehicle access to an arterial street.

Non-intersection locations are free from the hazards of turning vehicles, require vehicle control equipment for one street only, and may offer added convenience to students. However, they can present an element of surprise for drivers who do not expect pedestrian crossings and signal control between intersections. Therefore, special attention should be given to the signal head placement and the signs and markings used at non-intersection locations, to be sure drivers are aware of this special application. Parking should not be allowed within 100 feet in advance of the crosswalk, nor 20 feet beyond.

7D-7 Controllers

School signals which are installed only under the adequate gap warrant (sec. 7D-4) shall be the traffic-actuated type unless an intersection installation is fitted into a progressive system and uses pre-timed control.

The traffic-actuated signal, as its name implies, responds to vehicle or pedestrian actuations, and it is necessary that detector and controller equipment be designed for this service. The general characteristics of the various types of detectors and controls that have been developed for use with traffic-actuated equipment are described in a supplemental publication.⁶ More comprehensive descriptions and specifications are contained in standards adopted and published by the Institute of Traffic Engineers.⁷

7D-8 Pedestrian Detectors

Pedestrian detectors of the push-button or other type shall be designed to operate on a circuit not to exceed 18 volts. They may be mounted on signal standards, wood or steel poles, or individual posts. They should be conveniently located near each end of crosswalks where actuation is required. A mounting height of 3½ to 4

⁶ Traffic Control Devices Handbook—Supplement to the Manual on Uniform Traffic Control Devices.

⁷ Traffic Actuated Controllers and Detectors. Technical Report Number 3, Institute of Traffic Engineers, 1958.

feet above the sidewalk has been found best adapted to general usage. Permanent-type signs shall be mounted above or in unit with the detectors, explaining their purpose and use. At certain locations it may be desirable to supplement this sign with a larger sign suspended over the sidewalk to call attention to the push button. Where two crosswalks oriented in different directions, end at or near the same location, the positioning of pedestrian push buttons should clearly indicate which crosswalk signal is actuated by each push button. Additional push button detectors may be required on islands or medians where a pedestrian might become stranded.

Special purpose push buttons to be operated only by authorized persons should include a housing capable of being locked to prevent access by the general public. Instruction signs are not necessary in this case.

A pilot light or other means of indication may be installed with a pedestrian push button and normally shall not be illuminated. Upon actuation, it shall be illuminated until the pedestrian's green or WALK indication is displayed.

7D-9 Operation of Pedestrian Signals

At an intersection the four basic combinations of pedestrian signal intervals with vehicular signal operation are as follows:

1. Combined Pedestrian-Vehicular Interval—a signal phasing wherein pedestrians may proceed to use certain crosswalks and vehicles are permitted to turn across the said crosswalk (the pedestrian indication shall be flashing WALK).

2. Exclusive Crosswalk Interval—a signal phasing wherein pedestrians may proceed to use certain crosswalks but vehicles are not permitted to move across these crosswalks during the pedestrian movement (the pedestrian indication shall be steady WALK).

3. Leading Pedestrian Interval—a signal phasing wherein an exclusive pedestrian interval, in advance of the vehicular interval, is provided for pedestrians (the pedestrian indication shall be steady WALK). When the leading pedestrian interval is terminated, and a combined pedestrian-vehicular interval begins, the WALK indication may begin to flash.

4. All Pedestrian Phase—a signal phasing wherein pedestrians may proceed to cross the intersection in any direction during an exclusive phase while all vehicles are stopped (the pedestrian indication shall be steady WALK).

At non-intersection school signal installations, as there is no parallel vehicular movement, the pedestrian crossing is an exclusive interval.

Pedestrians should be assured of sufficient time to cross the roadway at a signalized intersection:

1. Where traffic signals are of the actuated type, control equipment should provide sufficient pedestrian crossing time when there has been a pedestrian actuation, whenever the minimum vehicular time is less than that needed by the pedestrians.

2. Where traffic signals are not of the vehicle-actuated type, pedestrian actuation may be used to provide sufficient pedestrian crossing time, or the vehicular time should be adjusted to provide the crossing time needed by pedestrians.

3. Under normal conditions, the WALK interval should be at least 7 seconds, so that pedestrians will have adequate opportunity to leave the curb, before the clearance interval is shown. However, the WALK interval itself need not equal or exceed the total crossing time calculated for the street width, as many pedestrians will complete their crossing during the flashing DONT WALK clearance interval.

4. A pedestrian clearance interval shall always be provided where pedestrian signal indications are used. It shall consist of a flashing DONT WALK indication. The duration should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb and travel to the center of the farthest traveled lane before opposing vehicles receive a green indication. (Normal walking speed is assumed to be 4 feet per second.) On a street with a median at least 6 feet in width, it may be desirable to allow only enough pedestrian clearance time on a given phase to clear the crossing from the curb to the median. In the latter case if the signals are pedestrian-actuated, an additional detector shall be provided on the island.

7D-10 Coordination with Adjacent Signals

A school signal at an established school crossing within half a mile of a signal controlling the same traffic should be coordinated with the adjacent signal.

Coordinated operation normally should include both pretimed signals and traffic-actuated signals within the appropriate distances.

7D-11 Vehicle Change Interval

A yellow vehicle change interval shall be used following each CIRCULAR GREEN interval and, where applicable, after each GREEN ARROW interval. In no case shall a CIRCULAR YELLOW indication be displayed in conjunction with the change from CIRCULAR RED to CIRCULAR GREEN.

The exclusive function of the yellow interval shall be to warn traffic of an impending change in the right-of-way assignment.

Yellow vehicle change intervals should have a range of approximately 3 to 6 seconds. Generally the longer intervals are appropriate to higher approach speeds.

7D-12 Location and Placement

The detailed standards and requirements governing the location and placement of all signals, including school signals, are given in Part IV of this Manual. The aspects of these standards and requirements most significant to school signals are given in the following sections.

7D-13 Visibility, Number, and Location of Signal Faces

Each signal face shall be so adjusted that its indications will be of maximum effectiveness to the approaching traffic for which they are intended.

Visors should be used on all signal faces to aid in directing the signal indication specifically to approaching traffic, as well as to reduce "sun phantom" resulting from external light entering the lens.

The visibility of signals shall be insured by providing, on each approach to an intersection, a minimum of two signal faces for through traffic. They should be continuously visible from the appropriate distances listed in table VII-1, up to the stop line, unless a physical obstruction exists.

Table VII-1

<i>85 Percentile Speed Limit</i>	<i>Minimum Visibility Distance (Ft.)</i>
20	100
25	175
30	250
35	325
40	400
45	475
50	550
55	625
60	700

Where physical conditions prevent drivers from having a continuous view of at least two signal indications as specified herein, a suitable sign shall be erected to warn approaching traffic. It may be supplemented by a Hazard Identification Beacon.

Unless physical conditions make it impractical, at least one, and preferably both of the signal faces as required above, shall be lo-

cated not less than 40 feet nor more than 120 feet beyond the stop line. Such signal faces shall be located between two lines intersecting with the center of the approach lanes at the stop line, one making an angle of 20 degrees to the left of the centerline extended and the other making an angle of 20 degrees to the right of the centerline extended.

When overhead signals are required, the signal faces for any one approach shall not be less than eight feet apart, measured horizontally between centers of faces.

At signalized mid-block crosswalks, there should be at least one signal face over the traveled roadway for each approach.

Pedestrian signal indications should be placed so they attract a pedestrian's attention and they should be readable from as far as the crossing width, to as close as 10 feet.

There shall be pedestrian signals located at each end of each established crosswalk.

The DONT WALK indication shall be mounted directly above or integral with the WALK indication.

Pedestrian indications may be mounted separately or on the same support with other signal heads. When mounted with other signal heads there shall be a physical separation between the two heads. The pedestrian signal head shall be so positioned and adjusted as to provide maximum visibility at the beginning of the controlled crossing.

The transverse location of a signal face mounted on the top of a post or on a short bracket from a post, shall conform to the requirements in section 7D-15.

7D-14 Height of Signal Faces

The bottom of the housing of a signal face not mounted over a roadway shall not be less than 8 feet or more than 15 feet above the sidewalk or, if none, above the pavement grade of the center of the highway.

The bottom of the housing of a signal face suspended over a roadway shall not be less than 15 feet or more than 19 feet above the pavement grade at the center of the roadway.

Within the above limits, optimum visibility and adequate clearance should be the guiding considerations in deciding signal height. Grades on approaching streets may be important factors, and should be considered in determining the most appropriate height.

Pedestrian signal faces shall be mounted with the bottom of the housing not less than 7 feet nor more than 10 feet above the sidewalk level, and so that there is a pedestrian indication in the line of vision of the pedestrian using the crosswalk to which it applies.

7D-15 Transverse Location of Traffic Signal Supports and Controller Cabinets

In the placement of traffic signal supports, primary consideration shall be given to ensuring the proper visibility of traffic signal faces as described in section 7D-13. However, in the interest of safety, traffic signal supports and controller cabinets should be placed as far as practicable from the edge of the traveled way without adversely affecting signal visibility.

Supports for post-mounted signals at the side of a street with curbs shall have a horizontal clearance of not less than two feet from the face of the curb. Where there is no curb, the support for a post-mounted signal shall have a clearance of not less than two feet from the shoulder within the limits of normal vertical clearance.

Signal supports should not obstruct a crosswalk.

No part of a concrete base for a signal support should extend more than 4 inches above the ground level at any point, except that this limitation does not apply to the concrete base for a rigid (non-breakaway) support.

On medians, the above minimum clearances for supports should be obtained where practicable. Any median supports which cannot be located with the required clearances should be of the breakaway type or should be guarded if at all practicable.

7D-16 Portable Traffic Control Signals

A portable traffic control signal not meeting all the requirements of this Manual, is not recognized as a standard traffic control device.

7D-17 Area of Control

A traffic control signal shall control traffic only at the intersection or mid-block location where the installation is placed.

On a divided highway with a wide median, the crossing of each roadway may be signalized as a separate intersection.

7D-18 Design Requirements for School Signal Indications

The detailed standards and requirements governing the design of signal indications for all signals, including school signals, are given in Part IV of this Manual. The aspects of these standards and requirements most significant to school signals are given in the following sections.

7D-19 Number of Lenses per Signal Face

Each signal face, except in pedestrian signals, shall have at least three lenses, but not more than five. The lenses shall be red, yellow or green in color.

Each pedestrian signal face shall have two indications, white and orange as specified in section 7D-23.

7D-20 Size and Design of Signal Lenses

The aspect of all signal lenses, except in pedestrian signals, shall be circular. There shall be two sizes for lenses, 8 inches and 12 inches nominal diameter.

In no case shall letters or numbers be displayed on the visible part of vehicular signal indications.

All lenses shall conform to the standards in the Standard for Adjustable Face Vehicle Control Signal Heads, Revised 1970, Institute of Traffic Engineers.

7D-21 Arrangement of Lenses in Signal Faces

The lenses in a signal face shall be arranged in a vertical or horizontal straight line, except that in a vertical array lenses of the same color may be arranged horizontally adjacent to each other at right angles to the basic straight line arrangement. Such clusters shall be limited to two identical lenses or to two or three different lenses of the same color.

In each signal face, all red lenses in vertical signals shall be located above, and in horizontal signals shall be located to the left of all yellow and green lenses.

The circular yellow lens shall be located between the red lens or lenses and all other lenses.

7D-22 Illumination of Lenses in Vehicular Signal Faces

Each lens shall be illuminated independently.

When a signal lens, except in a pedestrian signal, is illuminated and the view of such an indication is not otherwise physically obstructed, it shall be clearly visible to drivers it controls for a distance of at least $\frac{1}{4}$ -mile under normal atmospheric conditions.

The intensity and distribution of light from each illuminated signal lens should meet the standards set forth in the following Institute of Traffic Engineers reports: Standard for Adjustable Face Vehicle Traffic Control Signal Heads, Revised 1970, and a Standard for Traffic Signal Lamps, December 1967.

7D-23 Pedestrian Indications

Pedestrian signal indications should attract the attention of and be readable to the pedestrian both day and night and at all distances from 10 feet to the full width of the area to be crossed.

All pedestrian indications shall be rectangular in shape and shall consist of the lettered message WALK and DONT WALK. Only internal illumination shall be used.

When illuminated, the WALK indication shall be lunar white, meeting the standards of the Adjustable Face Pedestrian Signal Head Standard, 1963, of the Institute of Traffic Engineers. All except the letters shall be obscured by an opaque material.

When illuminated, the DONT WALK indication shall be Portland orange, meeting the standards referred to above, with all except the letters obscured by an opaque material.

When not illuminated, the WALK and DONT WALK messages shall not be distinguishable by pedestrians at the far end of the crosswalk they control.

The letters shall be at least 3 inches high for crossing where the distance from the near curb to the pedestrian signal indication is 60 feet or less. For a distance over 60 feet, the letters should be at least 4½ inches high.

The light source shall be designed and constructed so that in case of an electrical or mechanical failure of the word DONT, the word WALK of the DONT WALK message will also remain dark.

7D-24 Speed Limit Sign Beacon

A Speed Limit Sign Beacon is two CIRCULAR YELLOW lens sections each having a visible diameter of not less than six inches, or alternately, one or more CIRCULAR YELLOW lenses, each having a visible diameter of not less than eight inches.

The yellow lens color shall be in accordance with the requirements of the Institute of Traffic Engineers Standard for Adjustable Face Vehicle Traffic Control Signal Heads, Revised 1970.

Where two lens sections are used, they shall be vertically aligned, and they shall be alternately flashed.

Speed Limit Sign Beacons shall be flashed at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle.

All flashing contacts should be equipped with a filter for suppression of radio interference.

When illuminated, the Speed Limit Sign Beacon shall be clearly visible to all drivers it faces for a distance of at least a quarter of a mile, under normal atmospheric conditions, unless otherwise physically obstructed.

A Speed Limit Sign Beacon is intended for use with a fixed or variable Speed Limit sign.

7D-25 School Crossings at Existing Signal Installations

Intersections where pre-timed or traffic-actuated signals have been installed on the basis of vehicle warrants (Part IV) may be con-

venient locations for established school crosswalks. If so, their use should be encouraged and proper allowance should be made in the signal equipment and operation for this use (secs. 7D-27 and 28).

7D-26 Signal Indications

When an existing traffic signal installation is to be used as an established school crossing, pedestrian signals shall be located and mounted in the manner specified in sections 7D-14 and 7D-15.

7D-27 Signal Control

When an existing traffic signal installation is to be used as an established school crossing, the control of the pedestrian signal indications may be accomplished with the timing mechanism normally employed for the traffic signal. For this type of operation, the pedestrian phase or indication is given at a predetermined point during each cycle, or a push button is used to introduce the pedestrian phase or indication (in accordance with the needs of pedestrian traffic).

7D-28 Signal Operation

When an intersection with an existing traffic signal installation is to be used as an established school crossing, the pedestrian crossing interval can be combined with the vehicular movements in one of the four basic ways set forth in section 7D-9.

The timing of the pedestrian crossing phase shall be in conformance with the provisions of section 7D-9.

E. CROSSING SUPERVISION

7E-1 Types of Crossing Supervision

There are two types of school crossing supervision:

1. Adult control of pedestrians and vehicles with adult guards or police officers.
2. Student control of only pedestrians with student patrols.

Recommended practices for the organization, operation and administration of an adult crossing guard program are given in Adult Guards For School Crossings⁸ and Adult School Crossing Guards.⁹

Recommended practices for the organization, administration and operation of a student patrol program are given in Policies and Practices for School Safety Patrols.¹⁰

⁸ Adult Guards For School Crossings, Traffic Institute of Northwestern University, 1804 Hinman Ave., Evanston, Illinois 60204.

⁹ Adult School Crossing Guards, American Automobile Association, Washington, D.C. 20036.

¹⁰ Policies and Practices for School Safety Patrols, National Commission on Safety Education, 1201 16th Street, Washington, D.C. 20036; or National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611.

7E-2 Adult Guards

Adult guards may be used to provide gaps in traffic at school crossings where an engineering study has shown that adequate gaps must be created (sec. 7A-3).

7E-3 Legal Authority for Adult Guards

Adult guards should be special police officers appointed by the local police agency.

The local police agency should be responsible for the selection, training and supervision of adult guards.

7E-4 Choice of Adult Guards

High standards for selection of adult guards are essential. Adult guards must understand children and in addition should possess the following qualifications:

1. Average intelligence
2. Good physical condition, including sight and hearing
3. Mental alertness
4. Neat appearance
5. Good character
6. Dependable
7. Sense of responsibility for safety of children.

7E-5 Uniform of Adult Guards

Adult guards should be uniformed so that motorists and pedestrians can recognize them and respond to their signals. It is recommended that their uniforms be distinctively different from those worn by regular police officers.

7E-6 Operating Procedures for Adult Guards

Adult guards should not direct traffic in the usual police regulatory sense. In the control of traffic, they should pick opportune times to create a safe gap. At these times, their presence in the roadway serves as an easily recognized indication that pedestrians are about to use the crosswalk, and that all traffic must stop. When all traffic has stopped, the adult guard allows the children to cross.

7E-7 Police Officers

Police officers should be used for school crossing supervision only in emergency situations on a temporary basis or at very hazardous school crossings where the use of adult guards is not feasible.

7E-8 Student Patrols

Student patrols may be used to direct and control children at crossings near schools where there is no need to create adequate gaps in traffic.

Student patrols may be used to direct and control children at signalized intersections where turning movements are not a problem, and to assist adult guards in the control of children at crossing locations used by large numbers of children.

Student patrols should not be responsible for directing vehicular traffic. They should not function as police.

7E-9 Legal Authority for Student Patrols

Student patrols should be authorized by the local school board. School authorities should be responsible for organizing, instructing and supervising patrols with the assistance of the local police.

7E-10 Choice of Student Patrols

Student patrols should be carefully selected. They should be children from the 5th grade or higher. Leadership and reliability should be determining qualities for patrol membership.

Parental approval should be obtained in writing before a child is used as a member of a student patrol.

7E-11 Operating Procedures for Student Patrols

Student patrols control children, not vehicles. They should stop children back of the curb or edge of the roadway and allow them to cross only when there is an adequate gap in traffic.

F. GRADE SEPARATED CROSSINGS**7F-1 Function**

Grade separated crossings may be used to physically separate the crossing of a very heavy volume of school pedestrian traffic and a heavy vehicular flow.

7F-2 Types of Grade Separated Crossings

Grade separated crossings may be either overpasses or underpasses. The design should follow the guidelines given in the published policies of the American Association of State Highway Officials.¹¹ Ex-

¹¹ A Policy on Arterial Highways in Urban Areas, 1957, and A Policy on Geometric Design of Rural Highways, 1965; American Association of State Highway Officials, 341 National Press Building, Washington, D.C. 20004.

perience has shown that for pedestrian crossings overpasses are more satisfactory than underpasses, as overpasses are easier to maintain and supervise.

7F-3 Criteria for Use of Grade Separated Crossings

Grade separated crossings should be considered only when the physical characteristics of the location make such a structure feasible. If use of the grade separation will be less convenient than an at-grade crossing, barriers or supervision will be needed to assure a satisfactory level of use.

Part VIII. DEFINITIONS

8A-1 Definition of Words and Phrases

The words and phrases defined in the following sections shall, for the purpose of the Manual, have the meanings respectively ascribed to them in this Part of the Manual, except when the context otherwise requires.

8A-2 General Definitions

1. **Authorized Emergency Vehicle**—Such fire department vehicles, police vehicles and ambulances as are publicly owned, and such other publicly or privately owned vehicles as designated by the public body or official having jurisdiction.

2. **Crosswalk**

(a) That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway;

(b) Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface.

3. **Curb**—A vertical or sloping member generally along and defining the edge of a roadway.

4. **Curb line**—The boundary between a roadway and a sidewalk, usually marked by a curb.

5. **District, Business**—The territory contiguous to and including a highway, when within any 600 feet along such highway there are buildings in use for business or industrial purposes, including but not limited to hotels, banks, or office buildings, railroad stations, and public buildings which occupy at least 300 feet of frontage on one side or 300 feet collectively on both sides of the highway.

6. **District, Residence**—The territory contiguous to and including a highway not comprising a business district when the property on such highway for a distance of 300 feet or more is in the main improved with residences or residences and buildings in use for business.

7. **District, Rural**—Any territory not included in a business or residence district as defined herein, whether or not within the boundaries of a municipality.

8. District, Urban—The territory contiguous to and including any street which is built up with structures devoted to business, industry or dwelling houses situated at intervals of less than 100 feet for a distance of a quarter of a mile or more.

9. Expressway—A divided arterial highway for through traffic with partial control of access and generally with grade separations at major intersections.

10. Freeway—An expressway with full control of access.

11. Gore—The area immediately beyond the bifurcation of two roadways, bounded by the edges of those roadways.

12. Highway (or Street)—The entire width between the boundary lines of every way, publicly maintained, when any part thereof is open to the use of the public for purposes of vehicular travel.

13. Highway, Arterial—Any U.S. or State numbered route, controlled access highway, or other major radial or circumferential street or highway designated by local authorities within their respective jurisdictions as part of a major arterial system of streets or highways.

14. Highway, Controlled-Access—Every highway, street, or roadway in respect to which owners or occupants of abutting lands and other persons have no legal right of access to or from the same except at such points only and in such manner as may be determined by the public authority having jurisdiction over such highway, street, or roadway.

15. Highway, Divided—A highway with separate roadways for traffic in opposite directions.

16. Highway, Major—The roadway approach or approaches at an intersection normally carrying the major volume of vehicular traffic.

17. Highway, Minor—The roadway approach or approaches at an intersection normally carrying the minor volume of vehicular traffic.

18. Highway, Through—A highway or portion thereof on which vehicular traffic is given preferential right-of-way, and at the entrances to which vehicular traffic from intersecting highways is required by law to yield the right-of-way to vehicles on such through highway in obedience to a stop sign, yield sign, or other official traffic control device, when such signs or devices are erected as provided by law.

19. Intersection—

(a) The area embraced within the prolongation or connection of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways of two highways which join one another at, or approximately at, right angles, or the area within which vehicles traveling upon different highways joining at any other angle may come in conflict.

(b) Where a highway includes two roadways (30) feet or more apart, then every crossing of each roadway of such divided highway by an intersecting highway shall be regarded as a separate intersection. In the event such intersecting highway also includes two roadways (30) feet or more apart, then every crossing of two roadways of such highways shall be regarded as a separate intersection.

(c) The junction of an alley with a street or highway shall not constitute an intersection.

20. Median—The portion of a divided highway separating the traveled ways for traffic in opposite direction.

21. No Passing Zone—A section of highway designated by the public body or official having jurisdiction as one where overtaking and passing or driving to the left of the roadway would be especially hazardous.

22. Official Traffic Control Devices (or Traffic Control Devices)—All traffic signs, highway traffic signals, traffic markings, and other devices erected or placed on or adjacent to a highway or street by authority of the public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic.

23. Pavement—That part of a roadway having a constructed surface for the facilitation of vehicular traffic.

24. Pedestrian—Any person afoot.

25. Ramp—An inclined section of way over which traffic passes for the primary purpose of ascending or descending so as to make connections with other ways. Also, an interconnecting roadway of a traffic interchange, or any connection between highway facilities of different levels, on which vehicles may enter or leave a designated highway.

26. Right-of-Way—The right of one vehicle or pedestrian to proceed in a lawful manner in preference to another vehicle or pedestrian approaching under such circumstances of direction, speed and proximity as to give rise to danger of collision unless one grants precedence to the other.

27. Roadway—That portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or shoulder. In the event a highway includes two or more separate roadways, the term "roadway," as used herein, refers to any such roadway separately but not to all such roadways collectively.

28. Shoulder—The portion of the roadway contiguous with the traveled way for accommodations of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

29. Sidewalk—That portion of a street between the curb lines, or the lateral line of a roadway, and the adjacent property lines, intended for the use of pedestrians.

30. Street—(See highway).

31. Traffic—Pedestrians, ridden or herded animals, vehicles, street-cars, and other conveyances either singly or together while using any highway for purposes of travel.

32. Traffic Lane—A strip of roadway intended to accommodate the forward movement of a single line of vehicles.

33. Vehicle—Every device in, upon, or by which any person or property is or may be transported or drawn upon a highway, except devices moved by human power or used exclusively upon stationary rails or tracks.

8A-3 Definitions Relating to Signs

1. Guide Sign—A sign used to show route designations, destinations, directions, distances, services, points of interest, and other geographical or cultural information.

2. Lane-Use Sign—A sign indicating regulations governing use of specific lanes.

3. Legend—Word messages or symbols used on signs to cover specific meanings.

4. Public Parking Area (or Facility)—A parking facility available for use by the general public, with or without payment of a fee.

5. Regulatory Sign—A sign used to give notice of traffic laws or regulations.

6. Traffic Sign (or Sign)—A device mounted on a fixed or portable support whereby a specific message is conveyed by means of words or symbols placed or erected for the purpose of regulating, warning, or guiding traffic.

7. Warning Sign—A sign used to give notice of conditions on, or adjacent to, a highway or street that are potentially hazardous to traffic operations.

8A-4 Definitions Relating to Markings

1. Barrier Line—A line which, when placed parallel to a center or lane line, or to another barrier line, indicates that all traffic must not cross the line for purposes of overtaking and passing.

2. Center Line—A line indicating the division of the roadway between traffic traveling in opposite directions.

3. Channelizing Line—A line which directs traffic and indicates that traffic should not cross but may proceed on either side.

4. Delineator—A light-reflecting device mounted at the side of the roadway, in series with others, to indicate the alignment of the roadway.

5. Edge Line—A line which indicates the edge of the roadway.

6. **Lane Line**—A line separating two lanes of traffic traveling in the same direction.

7. **Object Markings**—Markings intended for use on obstructions within or adjacent to the roadway.

8. **Pavement Markings**—Markings set into the surface of, applied upon, or attached to the pavement.

9. **Stop Line (or Limit Line)**—A line which indicates where vehicles should stop when directed by a traffic officer or traffic control device.

10. **Traffic Markings (or Markings)**—All lines, patterns, words, colors, or other devices, except signs and power-operated traffic control devices, set into the surface of, applied upon, or attached to the pavement or curbing or to objects within or adjacent to the roadway, placed for the purpose of regulating, warning, or guiding traffic.

8A-5 Definitions Relating to Signals

1. **Back-Plates**—A strip of thin material extending outward parallel to the signal face on all sides of a signal housing to provide suitable background for the signal indications.

2. **Controller**—A complete electrical mechanism mounted in a cabinet for controlling the operation of a traffic control signal.

3. **Detector**—A device by which vehicles, streetcars, trolley buses, or pedestrians are enabled to register their presence with a traffic-actuated controller.

4. **Highway Traffic Signal**—Any power-operated traffic-control device, except a sign or a barricade warning light, or steady burning electric lamps, by which traffic is warned or is directed to take some specific action.

5. **Interval**—Any one of the several divisions of the time cycle during which signal indications do not change.

6. **Lane-Use Control Signal**—A highway traffic signal which is erected to control the direction of vehicular traffic movement in an individual lane.

7. **Major Street**—The roadway approach or approaches at an intersection normally carrying the major volume of vehicular traffic.

8. **Minor Street**—The roadway approach or approaches at an intersection normally carrying the minor volume of vehicular traffic.

9. **Optical Unit**—An assembly of a lens, reflector, light source, and other components if required, with the necessary supporting parts to be used for providing a signal indication.

10. **Pedestrian Detector**—A detector, usually of the push-button type, installed near the roadway capable of being operated by hand.

11. **Pedestrian Signal**—A traffic control signal which is erected for the exclusive purpose of directing pedestrian traffic at signalized locations.

12. **Pedestrian Signal Indication**—The illumination of a pedestrian signal lens or equivalent device.

13. **Pretimed Signal**—A type of traffic control signal which operates on predetermined scheduled time cycles and intervals.

14. **Signal Face**—That part of a traffic control signal provided for controlling one or more traffic movements in a single direction. Turning indications may be included in a signal face.

15. **Signal Head**—An assembly containing one or more signal faces.

16. **Signal Indication**—The illumination of a traffic control signal lens or equivalent device.

17. **Signal Installation**—All of the equipment and material involved in the control of traffic at one intersection by a traffic control signal.

18. **Signal Lens**—That part of the optical unit which redirects the light coming directly from the light source and its reflector, if any.

19. **Signal Support**—The physical means whereby a signal head is supported in a particular location.

20. **Signal System**—Two or more signal installations operating in coordination.

21. **Time Cycle**—The time period required for one complete sequence of signal indications.

22. **Traffic-Actuated Signal**—A type of traffic control signal in which the intervals are varied in accordance with the demands of traffic as registered by the actuation of detectors.

23. **Traffic Control Signal (Traffic Signal)**—A type of highway traffic signal, manually, electrically, or mechanically operated by which traffic is alternately directed to stop and permitted to proceed.

24. **Traffic Phase**—A part of the time cycle allocated to any traffic movement receiving the right-of-way or to any combination of traffic movements receiving the right-of-way simultaneously during one or more intervals.

25. **Train-Approach Signal**—A highway traffic signal which indicates to highway traffic, the approach and passage of railroad trains at a railroad-highway grade crossing.

26. **Vehicular Phase**—A traffic phase allocated to all traffic except pedestrians.

8A-6 Definitions Relation to Islands

1. **Approach End**—An end of an island or area between roadways which faces approaching traffic passing to one or both sides.

2. **Buffer**—A structure at the approach end of a safety zone designed to deflect or stop any vehicle which collides with it.

3. Island—(Traffic Island)—An area within a roadway from which vehicular traffic is intended to be excluded, together with any area at the approach thereto occupied by warning devices.

4. Island, Channelizing—A traffic island located in a roadway area to control and direct specific movements of traffic to definite channels.

5. Island, Divisional—A traffic island used to separate traffic moving in the same or opposite directions.

6. Island, Pedestrian Refuge—An island designed for the use and protection of pedestrians.

7. Raised Bars—A series of bars extending above the normal pavement surface to make any wheel encroachment obvious to a vehicle operator without loss of control of the vehicle.

8. Button—A rounded object extending above the normal pavement surface for the purpose of channelizing traffic movement.

8A-7 Definitions Relating to Construction and Maintenance Traffic Controls

1. Barricade—A portable or fixed barrier having object markings, used to close all or a portion of the right-of-way to vehicular traffic.

2. Barricade Warning Light—A portable, power-operated, lens directed, enclosed light used in either the steady burn or flashing mode to mark obstructions or hazards in construction and maintenance work areas.

3. Steady Burning Electric Lamps—A series of low wattage, yellow electric lamps used to mark obstructions or hazards in construction and maintenance work areas.

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